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ARCHIVES

OF

MEDICINE:

A RECORD OF PRACTICAL OBSERVATIONS AND ANATOMICAL AND CHEMICAL RESEARCHES CONNECTED WITH THE INVESTIGATION AND TREATMENT OF DISEASE.

EDITED BY

LIONEL S. BEALE, M.B., F.R.S.

VOL. I.

CONTAINING THIRTY-TWO PLATES AND NUMEROUS WOODCUTS.

With Original Papers

BY

Scott Alison, M.D.
Lockhart Clarke, F.R.S.
Arthur Farre, M.D., F.R.S.
W. A. Guy, M.B., Cantab.
J. W. Hulke, F.R.C.S.
E. C. Hulme, F.R.C.S.
C. Handfield Jones, M.D., F.R.S.
George Johnson, M.D.
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Charles Murchison, M.D.
John Ogle, M.D.
George Scott, M.D.
Robert Taylor, F.R.C.S.
R. B. Todd, M.D., F.R.S.

AND COMMUNICATIONS FROM MANY CONTRIBUTORS.

LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.

PREFACE.

THIS volume of the "Archives of Medicine" owes its existence to the encouragement and valuable assistance which has been given to me, as its editor, by numerous friends. It has long been my desire to see established in England a journal devoted to practical clinical observations and original memoirs upon various subjects bearing more or less upon the investigation and treatment of disease, and containing observations in all branches of minute anatomy and morbid anatomy, researches in animal chemistry, and new experiments carried out with all possible care in every department of physiology and pathology.

The opinion that future advance in the practice of our art mainly depends upon the minute investigation of morbid changes and an accurate knowledge of the processes concerned in the destruction and nutrition of tissues, has been often expressed, though not universally assented to. Many eminent men whose opinions are entitled to, and will certainly receive, great respect, have been led to form a very low estimate of the practical utility afforded by minute investigation to clinical medicine, and have even thought that scientific research would rather impede than assist the proper study of disease. It has been maintained that this minute work, although tending to produce refinement in diagnosis, could exert no beneficial influence upon the treat-

ment of disease. Some have feared that, from men's minds being so much taken up with minute details, they would fail to grasp those great general truths, and would no longer observe with the unaided eye those characteristic symptoms of disease which are at once seized upon by the thoughtful and experienced practitioner, and which have been, and probably will long continue to be, the only sure basis upon which the sound treatment of many cases can be conducted.

On the other hand, the number of those who do not entertain these fears for medicine is rapidly on the increase. They think that, although for a time advance will be almost restricted to diagnosis, yet that, eventually, improvement will be seen in our methods of treatment. They can see no reason why we may not still retain the practical knowledge we possess, and yet learn purely scientific truths, which will by and bye form the foundation for newly-acquired power over disease. Such men will, therefore, look upon this grave question from a different and more hopeful point of view, and it is important that the facts and arguments which have influenced them should be clearly expressed. Being of this number, and at the same time fully sensible of the sound judgment, of the earnestness of purpose and greater experience of many of those who differ from us, I am doubly anxious that the question should be thoroughly investigated in all its bearings. Many of us feel that a minute investigation of the chemical changes going on in the body in health and disease, a painstaking and laborious study of the alterations occurring in tissues and of the conditions which affect these, and such careful inquiries into the structure of morbid growths at different periods of their development as would enable us to write a history of their life would lead to very important practical ends. We hold that when we gain this knowledge we shall be in a better position to treat disease, and we look forward confidently to the time not far distant when the vast labours now being carried on by so many

earnest workers in this department shall add greatly to the results at present obtained, and when we shall possess more influence over the course of morbid processes than we have at present, and thus be instrumental in increasing the average duration of human life.

We hope and believe that from all this minute investigation we shall learn more about the action of the body in health and the nature of morbid changes than we know at present. Those who oppose its being carried out, think that we know as much of these processes already as can be of any practical use in clinical medicine. Its advocates, on the other hand, feel that there yet remains very much to be made out in this department of scientific research, and that the results to be obtained are so important that physicians might advantageously employ part of their time by devoting themselves to some branch of physiological or pathological investigation. It seems hardly possible that those who condemn microscopical and chemical research, and conclude that it can do no real good to medicine, can have considered that all the processes of disease of which as yet we know so little, and that all the incessant changes going on during life, affect particles of matter minute beyond conception. Truly, by employing the highest powers of the microscope at present at our command we are enabled to form only a very rough and imperfect conception of what is actually taking place. Our difficulties are much increased by our not being acquainted with methods of preparing textures for examination, without altering their natural appearances. Still it seems obvious that this rough and imperfect glimpse which we thus gain of the nature of the intricate changes going on in the body, must be better than no such information at all; and besides this, from what has been done already, we are justified in hoping that our means of investigating these wonderful processes will gradually be greatly extended and improved.

Surely, as guardians of the public health and as men whose aim and duty it is to learn how to prolong life, we are bound to investigate, as far as we are able, all the circumstances which in any way affect or modify the due performance of the different functions which constitute health; and as practitioners we certainly ought to make use of every means which science places at our disposal, to combat the deleterious influence of various external agencies, to retard morbid changes which have already commenced, and, when we can do no more, to place a patient, whose organs are impaired by disease, under the most advantageous circumstances for prolonging his life and for ameliorating his suffering.

While, therefore, it has been my endeavour to render the Journal in all respects a journal of *clinical medicine,* I have attempted to do so in the most extended sense in which the term can be used. I hope to receive practical clinical reports and papers on the history, progress, and treatment of disease, and, published in juxtaposition with these, will be the results of inquiries on special points carried out with all patience and care, and with all the delicate contrivances for exactness which modern science has placed at our disposal. With many who entertain similar views I look forward patiently, but with confidence, to the time when a full and sufficient answer will be given to those who now openly or tacitly assail all minute investigations, and, indeed, all earnest research after truths which seem to them to have no practical bearing, with the question of "What is the good of it?"

It is now nearly two years since the first number of the "Archives" was published, and, although the original design is by no means fully carried out in any number which has yet appeared, it is hoped that a sufficient indication of the aim and general object of the work is afforded by the present volume. Every department will be gradually increased, as further assist-

ance, of which I have already received so large a share, is afforded me by friends. Arrangements have been already made for extending the first section of the Journal which is devoted to "Clinical observations."

It has been felt that abstracts of well-marked cases would be of service, and in future a portion of the Journal will be set apart for their publication. From time to time the cases will be arranged in groups, and general conclusions drawn from them.

I am, therefore, desirous of receiving any cases of interest, *surgical* as well as *medical*, and it seems to me desirable to publish not only cases of rare and important affections but well-marked instances of ordinary maladies, such, for example, as uncomplicated pneumonia, erysipelas, rheumatic fever, caries, necrosis, &c. The case should be simply and carefully reported, and the course of treatment briefly but clearly described *in English*. From the report, a short history of the progress of the case and a statement of its results will be prepared, which will be published with remarks. This condensed history may be written by the reporter himself, or it can be prepared from his notes.

In the next number of the Journal it is proposed to publish plans for taking cases, in order that they may be more readily classified and compared, and the facts registered with as little trouble as possible.

In this part of the undertaking I shall receive most valuable help from my friend, Dr. John Ogle, who has very kindly offered to assist me in the work. It is anticipated that this department of the Journal will gradually become of considerable extent, and by following out the plan of grouping the cases as soon as possible, and forming a classified index, it is hoped that ready reference, which can alone render the clinical reports useful to the profession, will be ensured, while at the same time every fact of any importance will have due prominence given to it. The classification will not be postponed until a great number

of cases have accumulated, but will be proceeded with as they arrive.

Each volume of the "Archives" will be complete in itself, with Table of Contents and full Index, and from time to time classified Tables of the Contents of all the numbers will be made out.

The communications published in this volume have been arranged under the following heads:—

I. Clinical observations.

II. Original Researches in Anatomy and Physiology, and Morbid Anatomy and Pathology.

III. Results of the chemical and microscopical examination of the solid organs and secretions in a healthy and morbid state.

IV. Processes and instruments of practical value in carrying out Scientific Inquiries bearing upon medicine.

V. Condensed reports of researches published elsewhere.

Every contributor is entitled to receive 12 *copies of his paper.* Several authors of papers have expressed a desire to be furnished with a greater number of copies than 12. The arrangements for reprinting separate copies of papers are always complicated, expensive, and troublesome, but as I am fully conscious of the great convenience of these separate copies to the authors, I have arranged with Messrs. Harrison to supply them on certain conditions, and on the following terms:—

1. All copies above 12, not to be circulated until three months after the publication of the journal.
2. The expense to be borne by the authors, according to the following scale:—

Communications of 16 pages (1 sheet) and upwards, at the rate of 3*s.* per sheet per ten copies, including paper, and so on for each sheet. *Example—A paper of* 20 *pages*

will cost 3*s*. 9*d*. *per ten copies.* 75 *copies would be at the rate of* 9*s*. 6*d*. *per sheet.*

Communications of less than 16 pages and more than 8 at the rate of 3*d*. a page per ten copies. *Example*—*A paper of* 10 *pages will cost about* 2*s*. 6*d*. *per ten copies.*

Communications of 8 pages and less at the rate of about 4*d*. a page per ten copies. *Example*—*A paper of* 3 *pages will cost* 1*s*. *per ten copies.*

If more than 100 copies are required a very considerable reduction will be made in the above sums.

Plates 1*d*. *each copy, unless more than* 50 *copies are required. Coloured plates average* 3*d*. *each copy.*

3. *The Editor begs that all copies may be paid for* WHEN ORDERED, *as he cannot ask Messrs. Harrison to keep small accounts.*

⁂ All applications for extra copies must be made to the Editor as soon as the paper is in type.

It is not proposed to admit into the "Archives" any correspondence or merely controversial communications, but the pages of the Journal are open to scientific papers advocating or opposing any doctrines. The author of each paper is alone responsible for the facts and opinions brought forward, but the editor does not undertake to have published every communication which is sent to him. If not suitable to the Journal, from its great length, or from other causes, it will be at once returned to the author.

It must be admitted that the amount of letter-press, compared with that of many English and foreign journals, is small, but it is believed that this is more than compensated for by the plates, which are more numerous than in any other journal I am acquainted with. I believe that the usefulness and practical value of any work which treats of the minute anatomy of healthy and diseased structures, are directly proportioned to the number of illustrations it contains.

Drawings have therefore been made to take the place of description as far as possible, and all statements with regard to the size of objects have been altogether superseded by a plan which has answered exceedingly well. I cannot too strongly recommend this method to the attention of all who are engaged in microscopical observations.* The present volume is illustrated with thirty-two plates, and it is hoped that ere long the principle of free illustration will be carried to a still greater extent.

Some irregularity has occurred in the time of appearance of the numbers, which I very much regret. Still, in each year, two numbers have been issued, as originally proposed. I fear that at present it will not be possible to promise the numbers by a certain day, for contributors are often prevented by numerous engagements from completing their researches at the time they anticipated, and very frequently the engravings have not been finished until some time after they were promised. It is, however, expected that as the Journal becomes better supported and more widely known, it will appear regularly on the 1st of October and on the 31st of March. Its utility would be much enhanced, and probably its sale increased, if it appeared quarterly instead of half-yearly, but at present such an extension is not warranted. It is hoped that the number of annual subscribers will soon be sufficient to enable me to increase the resources of the Journal very considerably. The present volume must only be looked upon as a commencing effort, and I earnestly trust that gradually every department will be much expanded and the utility of the work increased.

LIONEL S. BEALE.

March 31*st*, 1859.

* The method is described in page 3. When the observer has once ascertained the magnifying power of each object-glass, and prepared scales of 100ths and 1000ths of an inch, which takes perhaps two hours, he need never again measure the diameter of any object; in fact, every object he has delineated can be measured at any time by the scale appended to his drawing.

ADVERTISEMENT TO No. I.

THE earlier years of professional life should be devoted as much as possible to the acquisition of those branches of learning which are likely to make men sound thinking practitioners,—to the storing up of facts, and to the study of principles which may be of use throughout life,—to the investigation, and if this may be, to the discovery of new truths from which fresh researches will proceed. In this way Harvey, and Hunter, and Bell, and Astley Cooper, and many other distinguished practical physicians and surgeons passed the early, and not the early years only, of their professional life. Their labours prove that valuable scientific research is not incompatible with very active professional duties, and may be carried out by those who at the same time are engaged in practice, or are pursuing clinical work in Hospitals and Dispensaries.

Even if it were certain that in our own time no practical gain in relieving suffering would be derived from scientific investigation, the want of results would be a very bad argument for abandoning our researches, seeing how many of the principles which we follow in the treatment of disease, are based upon the results of the scientific labours of those who have preceded us. It may surely be regarded as equally certain that scientific truths worked out in our own time will prove of real practical utility, if not to us, at least to our successors.

In England, such investigations are almost entirely left to the members of our profession; and perhaps no education is better adapted to produce scientific investigators than that of the student of medicine. Compelled to study many branches of physical science, and accustomed to apply theoretical problems to practical ends, at the conclusion of his career as a student, he is in a position to select for himself that path of original investigation which his natural taste, and perhaps various accidental circumstances, seem particularly to point out to him, and in which earnestness, industry, and patience, will surely enable him to be of good service.

It has long been my hope to be able to publish, from time to time, reports of the work done in my laboratory and micro-

scope room; but as this idea approached its fulfilment, I was led to form a more extended plan, and at length determined to ask for the help and co-operation of those who, like myself, are pursuing investigations bearing more or less directly upon medicine. Quite sure of receiving encouragement from many fellow-labourers, and fully conscious of a growing feeling in the profession of the real value and ultimate practical utility of scientific inquiry in the diagnosis and treatment of disease, I look forward with pleasure to the task of editing the "Archives," and shall feel thankful to friends who will give me any hints which are likely to increase the usefulness of the work.

The opinion has been expressed, that a journal devoted to original researches and scientific investigations, in connection with medicine, would receive support; but to make many of the subjects really intelligible, the papers must be freely illustrated. I have, through the assistance of Messrs. Harrison, been able to adopt a plan, not often followed, by which illustrations may be introduced, at comparatively small cost.

It has been considered the best course to publish the first number before applying for communications, in order that some idea of the general nature of the Journal may be formed by those whose support is so much desired. I have, however, received communications and cases from a few friends, to whom my thanks are specially due for this early help.

I shall introduce copious illustrations, feeling confident that drawings are really of much more use than long descriptions. I am anxious that the text should be as short as is compatible with a clear statement of the facts; and it is my desire, as far as possible, to substitute accurate representations of the objects for a minute description of their characters.

Each number will contain from *four to eight octavo pages* of *lithographs* besides several *woodcuts* inserted in the text. The illustrations will be accurate and drawn to a scale, but they will make no pretensions to artistic excellence. It is hoped, however, that their number will be progressively increased and their character improved. I shall be happy to receive suggestions and contributions for future numbers.

Every contributor will receive 12 *copies of his communication, free of expense.*

LIONEL S. BEALE.

October 1*st*, 1857.

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OF

MEDICINE.

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REMARKS UPON THE TREATMENT

OF

ACUTE INTERNAL INFLAMMATIONS.

(An Extract from a Clinical Lecture delivered in July, 1857.)

By R. B. Todd, M.D., F.R.S., Physician to King's College Hospital.

THE case of Jane Cook, aged twenty-two, affords a good illustration of the phenomena of disease in its most acute form. She has had pericarditis in connexion with rheumatic fever, some degree of endocorditis, and pneumonia with consolidation of about a fourth of the posterior part of each lung.

This patient is rapidly recovering, and, indeed, in an illness of unusual severity, she has had no serious drawback. On the 2nd of July rheumatic symptoms first showed themselves in pains and swelling of the lower joints. On the 6th of July a pericardial friction sound was first heard over the base of the heart, which soon became distinctly audible over its whole anterior surface. On the 7th bronchial breathing was heard at the posterior part of the lower third of the left lung, and on the 10th the right lung was similarly affected and to an equal extent. On the 12th vesicular breathing began to be audible in both lungs, and the bronchial breathing to disappear.

Now this patient was treated in the manner in which (with but slight modification) I have been for some years in the habit

of dealing with similar internal inflammations, especially those of the lungs and heart. Although my practice in such cases is now pretty well known, and I am proud to think is practised by very many of my pupils in various parts of this city and of the country, it may be useful if I take this opportunity of explaining to you the principles upon which it is based.

And first let me describe to you in detail, as a good instance of this treatment, that to which this girl Cook has been subjected.

On admission, while yet it was uncertain how far the rheumatic symptoms would extend, she was treated with alkalies and mild saline purgatives. Bicarbonate of potass in doses of from twenty to thirty grains were given every four or six hours, and very soon opium was freely given, when the cardiac affection manifested itself. As much as one grain of opium was given every fourth hour. Care was taken to keep the bowels open by giving an aperient draught daily of sulphate and carbonate of magnesia. Counter irritation was employed over the situation of the inflamed lungs by means of stupes of flannel soaked in turpentine; these were applied twice or thrice a day, and the region of the heart was freely blistered.

A principal and very important part of the treatment to which, as most of you know, I pay very special attention is that which I may call the dietetic portion. The object of this is to support the vital powers of the patient and to promote general nutrition, during the time when those changes are taking place in the frame which tend to check or to alter the morbid process, and to convert it into a healing process.

When a patient suffers from pneumonia, the tendency is for the lung to become solid, then for pus to be generated, and at last for the pus-infiltrated lung-structure to be broken down and dissolved. Such are the changes when matters take an unfavourable course. On the other hand, recovery takes place, either through the non-completion of the solidifying process, or by the rapid removal, either through absorption, or a process of solution and discharge, of the new material, which had made the lung solid.

It will scarcely be affirmed, even by the most ardent believer in the powers of the Therapeutic art, that any of the measures which are ordinarily within our reach, such as the administration of certain drugs, or the abstraction of blood, or the application of blisters, exercise a *direct* influence in effecting these changes. Save in the case of antidotes, which directly antagonise the proximate cause of the morbid state, medicines promote the cure of acute disease by assisting and

quickening some natural curative process. And he is the wisest practitioner, and will be the most successful therapeutist, who watches carefully the natural processes of cure—in other words, who studies the phenomena, both anatomical and physiological, which accompany them, and of which, indeed, they consist.

Let me, therefore, exhort you to look very carefully to this as a part of your clinical study. If you will be on the look-out, you may often meet with cases of acute disease, which recover with little or no medical treatment, and you may observe and note the clinical phenomena which they exhibit.

Allow me to anticipate your observation on this point, and to point out what you may look for in cases of pneumonia, and what you will certainly find in almost every instance.

First, the hot, often burning skin, which is so generally present in the first stages of pneumonia, will be exchanged for one bedewed with moisture, generally to the extent of free sweating.

Secondly, along with this sweating process there will be one of increased flow of urine, and very often a free precipitate of brick-dust sediment, lithate of soda, more or less deeply coloured.

Thirdly, not unfrequently expectoration becomes freer, the sputa are more easily discharged, they lose their characteristic reddish, rusty colour, and often they become very profuse and even purulent. Now and then the purulent sputa are so abundant that it is difficult to imagine that they can have come from any other source than an abscess.

Fourthly, the chemical characters of the pneumonic sputa exhibit an interesting contrast with those of the urine. In the height of the inflammatory state, the sputa contain common salt (chloride of sodium) in abundance, and the urine is entirely devoid of it. As the inflammation becomes resolved the salt returns to the urine and leaves the sputa.

Lastly, while all these changes are going on, the physiological functions which have been disturbed by the local malady, gradually approach their normal state. The quickened breathing, the accelerated pulse, the unnatural generation of heat gradually subside. As all these admit of being measured by numbers, you should tabulate them in your records of cases, and you will find on each succeeding day (under such circumstances as I am now referring to) the figure assignable to each function gradually become lower until you arrive at the normal.

Now is it not plain from all this that the process of resolution of pneumonia is a distinct natural process affected by the

various physical agencies which are concerned in the nutrition of the lung? A material which clogs the air-cells and minute tubes is removed, chemical changes of the most marked and obvious kind accompany the deposition and the removal of this material, and certain functions of excretion become strikingly augmented, as if for the purpose of getting rid of some noxious matter out of the circulation. A more exact and minute analytic chemistry than we have at present will, at some future time, beyond doubt, detect more minute changes in the blood and determine the exact nature of the discharged matters.

One other remark I must make in connexion with this subject. These acute internal inflammations are very often—I suspect always—connected with the undue prominence of some peculiar diathesis—the gouty or the rheumatic for instance—sometimes the scrofulous. Of these diatheses the main characteristic is the generation of some peculiar morbid matter which, when accumulated in undue quantity in this or that organ, gives rise to inflammation in it. And the determination of the morbid matter to the lung, or the pleura, to a joint or a muscle, will often depend on the direct influence of cold, or of an unwonted amount of exercise, or of some mechanical injury. The evil is to be remedied by the diminution of the intensity of the diathesis. This is done naturally, and is to be imitated artificially, by the elimination of the morbid element through the channels of augmented excretions, such as the sweat, the urine, and the secretions of the alimentary canal.

You will perceive, then, that my argument may be thus summed up. Internal inflammations are cured, not by the ingesta administered, nor by the egesta promoted by the drugs of the physician, but by a natural process as distinct and definite as that process itself of abnormal nutrition to which we give the name of inflammation. What we may do by our interference may either aid, promote, and even accelerate this natural tendency to get well; or it may very seriously impair and retard, and even altogether stop, that salutary process.

If, then, this view of the nature of the means by which inflammation is resolved in internal organs be correct, it is not unreasonable to assume that a very depressed state of vital power is unfavourable to the healing process. Indeed, if you watch those cases in which nothing at all has been done, or in which nothing has been done to lower the vital powers, you will find that the mere inflammatory process itself, especially in an organ so important as the lung, depresses the strength of the patient each day more and more.

(*To be continued.*)

ON THE MANNER IN WHICH THE DRAWINGS ILLUSTRATING THE PAPERS HAVE BEEN MADE, AND OF OBTAINING LITHOGRAPHS FROM MICROSCOPICAL DRAWINGS.

I HAVE always felt it very desirable that the description of scientific observations should be curtailed as far as is consistent with accuracy and perspicuity in the statement of the results, and it is my desire, as far as possible, to see drawings take the place of long and necessarily tedious descriptions of observations. Instead of alluding to the dimensions of an object in the text, the reader will be referred to the scales appended to every plate, and with the aid of very little trouble, the diameter of every object depicted may be readily ascertained. For all ordinary purposes it is only necessary to compare roughly the size of the drawing with the scale magnified in the same degree as the specimen itself, but in those instances where great accuracy is important, a pair of compasses may be used.

In comparing the representation of the same object delineated by different observers, it will be often found that great confusion has been produced in consequence of the magnifying power of the object-glass not having been accurately ascertained, and an object said to be magnified in the same degree by two authorities is not unfrequently represented much larger by one than by the other. This arises from the magnifying power of the glasses not having been accurately ascertained.

I cannot too strongly recommend all microscopic observers to ascertain for themselves *the magnifying power of every object-glass*, and to prepare, in the manner presently to be described, *a scale of measurement by which the dimensions of every object can be at once ascertained.*

The inconvenience of not being acquainted with the number of diameters which any object represented in a drawing is magnified, has been often felt; for without this it is impossible to judge of its real size. And, on the other hand, the annoyance of reading a long description of minute objects, differing slightly in size from one another, the dimensions of which have been accurately noted, is very great; while no corresponding advantage is derived from such minute measurements. The text becomes occupied with a multitude of figures of but little interest to the reader. At the same time, it is very desirable that the careful observations of different persons should be readily comparable with each other. Elaborate researches are not unfrequently deprived of much of their value in conse-

quence of measurements having been carelessly taken, or the magnifying power of the glasses wrongly expressed.

The plan of appending to every microscopical drawing a scale magnified in the same degree as the object represented, supersedes the necessity of giving measurements in the text, while it is free from any of the objections above referred to. I propose to describe briefly a very exact, and at the same time a very simple, method of applying scales to microscopical drawings. All the drawings illustrating the editor's papers may be measured by the scales at the bottom of the page, and he strongly recommends all contributors to follow the same plan.

To carry out this it is necessary to ascertain the magnifying power of every object-glass, and to be provided with a stage micrometer divided into 100ths and 1000ths of an inch.

*Mode of ascertaining the magnifying power of the object-glass.** —A glass micrometer divided into 100ths of an inch is placed in the focus of the object-glass of the microscope, which is arranged horizontally. The neutral tint glass-reflector is fitted to the extremity of the eye-piece, and the light carefully arranged so as to render the micrometer lines distinctly visible. Care must, however, be taken that the distance from the object-glass to the reflector is the same as from the latter to the paper beneath it, upon which the magnified micrometer lines may now be traced. A four or six-inch scale accurately divided into 10ths of an inch is now applied to the magnified 100ths of an inch, and the magnifying power of the glass is at once ascertained. Suppose each magnified 100th of an inch covers 1 inch, the magnifying power will be 100 diameters, if an inch and 3 tenths 130 diameters, if 4 tenths of an inch 40 diameters, and so on, each 10th of an inch corresponding to a magnifying power of ten times.

If we wish to ascertain the magnifying power of one of the higher object-glasses, a micrometer divided into 1000ths of an inch should be employed instead of the one just alluded to. In this last case, each tenth of an inch upon the scale corresponds to a magnifying power of one hundred, instead of ten diameters. Any fractional parts can be readily estimated if we have a very accurately divided scale. This process must be repeated for every object-glass, as well as for each different eye-piece employed with the several objectives.

To ascertain the Diameter of an Object.—If an object be

* This mode of measuring is alluded to in several works on the microscope, but the editor considers it sufficiently important to repeat here, especially as the drawings illustrating papers published in the "Archives" have been copied in this manner.

substituted for the micrometer, and its outline carefully traced upon paper, its dimensions may of course be easily ascertained by comparison with the micrometer lines. The magnified power used being the same in both cases.

In order to apply this plan to microscopical drawings generally, the following seems to be the simplest method of proceeding, and saves much trouble. Scales are carefully drawn upon gummed paper; the magnifying power, and the micrometer employed, being written against them as represented in the plates. If a number are drawn together one of the rows can be cut off and appended to the paper upon which the drawing, magnified of course to the same degree, has been made. This is the plan I have followed in all the drawings which illustrate my observations, and the scales have been copied in the lithographs. All magnifying glasses of the same focus do not magnify in precisely the same degree, so that it is necessary for every observer to ascertain for himself the magnifying power of his lenses, and he may construct little tables in the manner I have described.

In order to make an accurate microscopical drawing, the image of the object is carefully traced on paper with the aid of the glass-reflector, and afterwards finished by the aid of the eye alone. In order to obtain the size accurately, care must be taken that the distance between the reflector and the paper is the same as that between the former and the object-glass. The drawing having been finished, one of the scales made as above described may be gummed on in one corner of the paper.

Of Drawing Objects in the Microscope, from which it is intended to take Lithographs.—The lithographs illustrating the papers in the present number have been made by copying the image, with the aid of the reflector, on transfer-paper, with lithographic ink or chalk.*

The drawing on the transfer-paper being complete, is transferred to a finely grained lithographic stone and properly fixed; impressions may then be taken off.†

* The best transfer-paper for this purpose is made of India paper. The ink and chalk can be purchased at any lithographer's. Fluid lithographic ink answers very well, and was used in making the drawings.

† The drawings have all been carefully copied from the objects themselves on transfer-paper in my house, and then transferred to the stone. The transfers have been made and the impressions printed off by Messrs. Harrison and Sons, of St. Martin's Lane, and it is only right that I should thank those gentlemen for the trouble and interest they have taken, and for the kindness which they and their workmen have always shewn in carrying out this plan of producing the drawings, as well as other suggestions which have been made.

ON THE PRESENCE OF CHOLESTERINE IN URINE.

SOME years ago, when examining the fatty matter which accumulates in the epithelial cells passed in the urine in considerable number in cases of fatty degeneration of the kidney, I was surprised to find that it contained a considerable quantity of cholesterine. This fact was stated in an introductory lecture which I gave in November 1852, and I propose now to describe the method employed for its detection, and to consider briefly one or two questions of interest connected with the presence of this substance in the urine. The only cases in which cholesterine seems to have been detected in urine are those which are referred to in Simon's chemistry. Gmelin is said to have found cholesterine in the urine in a case in which the flow of bile was impeded, and Möller twice detected it in kiestein, the film which rises to the surface of the urine of pregnant women, and contains sometimes much fatty matter.* It is not stated, however, if the crystalline form of the crystals was made out.

Other authorities, among whom is Lehmann, state that cholesterine has not been detected in urine.

The first case which I examined was that of John Ryan, a patient in King's College Hospital in 1850, under the care of Dr. Todd. The urine was pale, of acid reaction, specific gravity 1020, and contained albumen. The pale flocculent deposit consisted principally of fat cells.

The deposit from upwards of seven gallons of urine was collected upon a filter. It was dried over a water-bath, and digested in a mixture of alcohol and ether. The solution was filtered, and after being concentrated by evaporation, was allowed to cool. Crystals of cholesterine were formed in considerable number. These were subjected to microscopical examination. The fatty matter in this case was found to be composed of at least three distinct forms of fat, but in consequence of the very small quantity obtained for observation, it was not possible to examine their characters very minutely. The deposit from this urine contained—

1. A dark brown fat in very small quantity which was soluble in ether, but insoluble in hot and cold alcohol.

2. A light brown saponifiable fat, soluble in hot but insoluble in cold alcohol.

3. A considerable quantity of pure cholesterine, which originally existed in the urine dissolved in the other fats.

The next case of fatty degeneration of the kidney submitted

* Casper's Wochenschr: January 11—18, 1845, quoted in Franz Simon's Animal Chemistry, vol. ii. pp. 313, 333.

to examination was that of a man named Tiedeman, also a patient of Dr. Todd's, in King's College Hospital. The fatty matter obtained from 24 pints of urine weighed only ·47 grs., but from this a great number of crystals of cholesterine were obtained by extraction with alcohol.*

The deposit of the urine of a third case of fatty degeneration of the kidney has been submitted to examination, and cholesterine has been discovered in this instance also.

In one case in which the deposit had been kept for some time in a preservative fluid consisting of wood-naphtha, creosote, and water, the cholesterine had separated from the other constituents of the oil globules, in the form of rhomboidal tablets.

The fatty matter deposited in the kidney in these cases also contains a large proportion of cholesterine, and in a future communication I propose to give the results of chemical analyses of the kidney in fatty degeneration. I have detected the presence of cholesterine in the fatty matter of so many organs in a state of fatty degeneration as to justify the conclusion that the formation of this substance is intimately connected with the changes taking place in this morbid process.

When cholesterine occurs in the urine it is always dissolved in other fatty matters, so that its presence cannot be detected except by extraction with alcohol and subsequent crystallization. It forms a part of the constituents of the minute fat globules contained in the epithelial cells and casts of the uriniferous tubes, which Dr. Johnson has proved to be so characteristic of this form of kidney disease.

Surprise has often been excited by observing that oil globules passed in the urine in these cases, sink to the bottom of the vessel, when we should expect rather to find the fatty matter rising to the surface by reason of its lightness. That the cell-walls, and casts, are not the sole cause of this subsidence is proved by the fact that individual oil globules, quite free from these structures, are frequently found at the bottom of the vessel with the deposit. This subsidence is probably in some measure due to the quantity of the cholesterine entering into the composition of the fatty matter. Crystals of cholesterine sink in fluids of a specific gravity even some degrees above 1000.

I have not been able to detect cholesterine in the urine in any other morbid condition than in that above referred to. Although I have at present only searched for it in four cases of fatty degeneration, in consequence of the difficulty of obtaining

* Clinical lectures on certain diseases of the urinary organs and on dropsies, by Dr. Todd.

sufficient quantity of the deposit to work upon, the circumstances which I have enumerated render it very probable that it is a constituent of the fatty matter present in the urine in all cases of fatty degeneration of the kidney.

I shall have occasion to describe elsewhere the characters of the fatty matter present in other tissues in state of fatty degeneration, but I may remark here that cholesterine is a very constant constituent, and I have detected it in the large cells (*granular corpuscles*) containing oil globules, which are abundant in the fluid of *ovarian dropsy, and sometimes in hydrocele,* and in that found in cysts generally;* in similar cells which are common in *sputum,* and are derived from the surface of the mucous membrane of the bronchial tubes; in the cells which are frequently very numerous about the *small arteries of the brain* in cases of *white softening,* in those found in cases of the so-called *fatty degeneration of the placenta,* and in other situations.

CASES OF CHYLOUS URINE—ANALYSES OF TWO SPECIMENS OF THE URINE.

FOR the notes of the following interesting case, as well as for the specimens of urine which I analyzed, I am indebted to my friend Mr. Cubitt, of Stroud. As cases of chylous urine are so rare in this country, I think it desirable to publish the history of the patient. Most of the cases recorded have occurred in the inhabitants of warm climates, or in persons who have lived for some time in hot countries.

"Mrs. S——, aged 50, native of Norfolk, in which county she has always resided, has been married 29 years, and has had five children, the last of which died in its second year. The youngest now living is 20. The catamenia ceased at 43.

"Till within the last four years she has usually enjoyed good health, but at that time had a severe attack of influenza. She continued more or less out of health during the six or nine following months, and soon after this period her urine assumed a milky appearance, which character it has retained up to the present time (November 1849), except at intervals of unfrequent occurrence and of short duration. The disorder would seem to

* The bodies described as *granular corpuscles, inflammation globules, compound granular cells, exudation corpuscles,* and known by other names, are really composed of a number of minute oil globules, aggregated together in the form of a spherical mass which not unfrequently becomes invested with albuminous matter, resembling a cell-wall, but I believe that usually the albuminous material is deposited with the oil globules, and therefore that no true envelope or *cell-wall* exists.

have been gradually progressive, as the urine, which was at first only turbid and opalescent, has become by degrees more and more opaque, so that when I saw it, the unassisted eye could not distinguish between it and milk: moreover, after the lapse of a few days, a rich kind of cream rises to the surface. It is almost entirely free from any urinous odour, and has a faint, sweetish smell, something resembling that of ripe apples. In the mean time the general health has been more and more failing, and the digestive functions imperfectly performed; the patient has complained of loss of appetite, pain at the epigastrium after eating, slight headache with nausea, palpitations, and other dyspeptic symptoms. She has been losing flesh, suffers from pain in the back and loins without tenderness, from aching of the limbs, incapability of exertion, and other evidences of general debility, but still when the duration of the disease is taken into account, the general health may, upon the whole, be said to have suffered little. She states that throughout the affection, fatigue, whether of mind or body, unusual exertion, excitement, late hours, distress, anxiety, immediately renders the milky character of the urine more marked. She has been under the care of several medical men, as well as of some professed quacks (none of whom have ever examined the urine) without benefit; nevertheless, she has found that for the time, brandy and isinglass, or compound spirits of lavender, has never failed to clear the urine, but without at all improving the general health. She seems to derive *temporary relief from all kind of stimulants.* Occasionally, and without any apparent cause, the urine reassumes its ordinary appearance, but this is of rare occurrence, and its duration never exceeds two or three days. At no one time has she passed milky urine *during the day.* It is only the urine passed in the morning, after the night's sleep, which has ever presented a milky character. Occasionally, this urine settles down into a tremulous jelly, which takes the shape of the containing vessel, and more than once this spontaneous coagulation has taken place within the bladder itself; and in consequence of the impaction of small masses in the urethra, the patient has suffered from temporary retention of urine. She has tried various kinds of diet, but without any visible effect upon the urine. The quantity secreted appears normal, and there is no unusual frequency of micturition. The appetite has never been inordinate, or the thirst unnatural; the bowels are inclined to be costive. There is nothing remarkable about the state of the skin. She has suffered a good deal from pain in the back and loins, but there is no tenderness in this locality, and the uneasiness seems to depend upon exertion, and appears to

be connected with general debility. There has never been any dropsy, and she has suffered from no cardiac or pulmonary symptoms, but such as may be accounted for by the dyspepsia; but I have not had an opportunity of examining the chest. She has never had severe headache, vertigo, vomiting, or other cerebral symptoms. Has never had rheumatism, fever, or any inflammatory attack, has not been salivated, and has no reason to suppose she has suffered from exposure to cold. At the time when I saw her, the tongue was slightly furred, P. 70, small and soft, R. 20 and the skin cool, but there was a haggard appearance about the countenance, and a dark circle around the eyes, with slight bagging of the skin in this situation."

Mr. Cubitt inquired as to this patient's state in April 1857, and informed me that occasionally she passes chylous urine, but only for a short time. The symptoms seem to have become less marked. She has been taking no medicine, and latterly has been in better general health than for several years past.

The first specimen of urine was passed in the morning. It was perfectly fluid, and had all the appearance of fresh milk. It had neither a urinous smell nor taste. Upon the addition of an equal volume of ether it became perfectly clear, but when the ether was allowed to evaporate by the application of a gentle heat, the fatty matter could be again diffused, by agitation, through the urine, which regained its milky appearance although it appeared rather more transparent than before the addition of the ether. Upon examination, however, by the microscope, instead of the minute granules visible in the first instance, numerous large and well-defined oil globules were observed.

Specific Gravity 1013. *Reaction,* neutral.

A little of the urine was evaporated to dryness. The dry residue was very greasy to the touch. It was treated with ether, and upon evaporating the ethereal solution, a considerable quantity of hard and colourless fat was obtained.

The urine was found to contain in 1000 parts—

Water	947·4	
Solid matter	52·6	
Urea	7·73	
Albumen	13·00	
Extractive matter with Uric Acid	11·66	
Fat insoluble in hot and cold Alcohol, but soluble in Ether	9·20	13·9
Fat insoluble in cold Alcohol .. .	2·70	
Fat soluble in cold Alcohol	2·00	
Alkaline Sulphates and Chlorides....	1·65	
Phosphates	4·66	

The second specimen was passed during the same day. It was slightly turbid, but contained a mere trace of deposit consisting of a little epithelium, with a few cells larger than lymph corpuscules, and a few small cells, probably minute fungi. Not the slightest precipitate was produced by the application of heat, or by the addition of nitric acid.

Specific Gravity 1010. *Reaction,* very slightly acid.

In 1000 parts it contained :—

Water	978·8	
Solid matter	21·2	
Urea	6·95	
Uric Acid	15	
Extractive matter	7·31	
Alkaline Sulphates and Chlorides	5·34	
Alkaline Phosphates	1·45	1·60
Earthy Phospates	·15	

The presence of so large a proportion of fatty matter (13·9 grs.) in the first specimen and its complete absence in the second, should be noted.

The proportion of the constituents in 100 grains of the solid matter of these two specimens of urine is given in the following table; I, is the chylous, II, the clear specimen :—

	I.	II.
Solid matter	100·00	100·00
Urea	14·69	32·78
Albumen	24·71	—
Extractive matter, Uric Acid	22·17	35·18
Fatty matter	26·43	—
Alkaline Sulphates and Chlorides....	3·14	25·18
Phosphates	8·86	7·54

Microscopical Characters of the Deposit.—The slight deposit which formed after the chylous urine had been allowed to stand for some time in a conical glass vessel, consisted of a small quantity of vesical epithelium, and some small slightly granular circular cells about the size of a blood corpuscle.

No oil-globules could be detected upon the surface of the urine or amongst the deposit, and the fatty matter, which was equally diffused throughout, was in a molecular or granular form. By examining the urine with the highest powers, only very minute granules could be detected. These exhibited molecular movements. Indeed, it may be said, that the microscopical characters of this urine closely resembled those of chyle.

Only a few of the granular cells could be discovered in the clear specimen, in which there was scarcely any visible deposit.

In a case which occurred in the practice of Mr. Gossett, and which is related by Dr. Golding Bird, an alternation in the character of the urine similar to that noticed in the present case occurred. The urine which was passed in the morning was chylous, while that secreted some hours afterwards was clear, pale, and transparent. The clear specimens, however, contained albumen. The chylous specimen which I examined did not coagulate spontaneously, as often occurs in these cases. In the case reported by Dr. Bence Jones, specimens of urine were frequently passed which were perfectly clear.

L'Heretier, and the late Dr. Franz Simon, of Berlin, state that these specimens of milky-looking urine contain oil globules, but the greater number of authors who have met with such cases have failed to detect oil globules in the urine. In the present instance they were certainly absent, and the fatty matter existed in a molecular form only.

In Dr. Bence Jones' case, oil globules were present in one or two instances, but in other specimens the fatty matter was present in a molecular state.

In true cases of chylous urine, the fatty matter, in a molecular state, filters through the walls of the vessels, and escapes at once into the urine, while in those instances in which actual globules are observed, the fatty matter is absorbed into the interior of the cells, where it remains a sufficient time to become converted into distinct oil globules. Globules thus formed may afterwards become separated from each other and may appear in the urine as free oil globules. It is, however, very probable, that after chylous urine has been allowed to stand for some time, the granular fatty matter may become aggregated in masses so as to form distinct oil globules.

In a case of albuminous and fatty urine reported by Dr. Bence Jones,* oil globules and streaks of oil were detected upon the surface of the urine which was passed in the morning, by microscopical examination. In two other specimens passed later in the day, fatty matter in a molecular form, but no oil globules, were discovered. Upon standing, a coagulum formed in the urine. These specimens contained about 50 grains of solid matter in 1000 of urine. The patient was a Scotchman, aged 32. His work was hard, and he was subject to privations. The urine was first observed to be thick and white about Christmas 1848, and at this time, the chief symptom from which he suffered, was acute pain in the loins.

Many of the patients whose cases are recorded, have suf-

* Vol. 3 of the "Medico-Chirurgical Transactions."

fered from severe pain in the region of the kidneys; but this may be accounted for by general debility, associated with this condition of urine, as well as on the supposition of the existence of organic disease of the kidneys. Indeed, the pain referred to in this locality, seems to partake more of the character of muscular pain than of pain seated in the kidneys themselves.

The following are two analyses of the urine in Dr. Bence Jones' case.

The first was made on October 19th, and the second was passed some time afterwards on the same day on which the patient was bled.

Water	955·58	943·13
Solid matter	44·42	56·87
Albumen	14·03	13·95
Urea	13·26	24·06
Fatty matter....	8·37	7·46
Saline residue	8·01	10·80
Loss	·75	·60

The chylous urine contained blood corpuscles.

The serum of the blood was not milky, but the blood contained in 1000 parts 240·03 of solid residue, which contained of fatty matter ·62; fibrin, 2·63; blood globules, 159·3; solids of serum, 78·1.

Dr. Bence Jones showed, in some valuable experiments on this case, that in complete rest albumen ceases to be passed.*

The urine was not chylous from February 14th, 1850, to October 4th, 1851, when it was again slightly chylous. The beneficial change was entirely attributable to *gallic acid*. At first 20 grains three times a-day were given, but this was afterwards diminished.

Dr. Bence Jones mentions another case of a gentleman aged 40, who passed the greater part of his life in the West Indies. The chylous condition of the urine was increased both by mental and bodily exertion.

The urine was sometimes clear for several days together, sometimes white after dinner, and clear all the rest of the day. It was more frequently chylous after animal than after vegetable food.

Another case is reported by Dr. Priestly.†

The boy was only 11 years of age. He was born at the Cape of Good Hope, and was taken as a child to the Isle of France, and while there had frequent attacks of hæmaturia and chylous urine. The attacks came on at intervals of weeks or months. He was placed in the autumn of 1855 under the

* Phil. Trans., 1850. † Med. Times and Gazette, April 18th, 1857.

care of Dr. Simpson of Edinburgh. Various plans of treatment were tried in vain. He was confined to the house, and passed as much as 50 to 55 ounces of chylous urine daily. He gradually became weaker, and died apparently from asthenia.

A fortnight before death the urine lost its milky appearance and the feet became œdematous.

Every tissue appeared bloodless, and there was considerable emaciation. The kidneys were pale, rather larger than natural. Throughout the greater part of both kidneys the epithelium was found to contain numerous oil globules.

Dr. Priestly suggests the possibility that this case of chylous urine may have been associated with Bright's disease.

No lesion likely to account for the production of the chylous urine has been met with in the post-mortem examinations of the cases of this condition which have been made, and most observers consider that the chylous condition of the urine does not depend upon a morbid state of the kidneys. Dr. Elliotson, on the other hand, inclines to the view that the kidneys are to be regarded as the seat of the affection. He gives the history of a very interesting case in the "Medical Times and Gazette" for September 19th, 1857.

Various plans of treatment have been tried in cases of chylous urine, but without very satisfactory results.

Astringents have proved useful in many instances, and in one of Dr. Bence Jones' cases the pressure of a tight belt "relieved the pain and rendered the urine slightly less chylous."

Dr. Prout found that in some of his cases temporary relief resulted from the use of the mineral acids and astringents, as alum and acetate of lead. Opium also arrested some of the symptoms for a while. Dr. Bence Jones has tried a variety of remedies, but the greatest advantage seems to have been derived from the use of astringents. Tannic acid, acetate of lead, and nitrate of silver were employed. Matico afforded some relief, but the most valuable remedy in Dr. Bence Jones' hands was gallic acid. Its good effects were probably due to its astringent properties and not to any specific action. The chylous character of the urine and the albumen disappeared two days after the commencement of the use of this drug, and one case seems to have been cured by its long-continued use.*

In Dr. Priestly's case the gallic acid caused such nausea that it was considered expedient to abandon its use.

Gallic acid was also tried by Dr. Goodwin of Norwich, in a case which came under his care. He says "gallic acid ap-

* For the results of a daily examination of the urine for some weeks while the patient was on gallic acid, See Phil. Trans., 1850.

peared to exert great influence in restraining the milky appearance of the urine. The patient took it for about 9 months in 1855 and 1856, and I found his water perfectly normal in colour after 6 months' steady use of it in doses of $\frac{1}{2}$ a drachm 3 times a-day. He then discontinued its use and went to work. In 4 or 5 days the same milky appearance presented itself, and was again removed by taking the gallic acid. He could at any time render the urine nearly normal in appearance by taking this drug; but it was necessary to avoid hard work. He only complained of occasional dimness of sight and deafness, but it was not easy to make out to what cause these symptoms were due. He left off attending the hospital in September last, when my note is as follows: "Has not had any gallic acid for 3 weeks, and the urine is now slightly opaline in appearance. Sp. gr. 1010; the temperature of air was about 50°. He passes $7\frac{1}{2}$ pints daily on the average. It does not coagulate with heat or nitric acid, or both combined."

Dr. Goodwin has not been able to ascertain anything of the further history of the case since September.

The very large quantity of fatty matter present in the first specimen of urine, and its total absence in the urine passed only a few hours afterwards, is remarkable in the case which has been reported, page 12, and confirms the conclusions which previous observers have arrived at with reference to this condition, viz., that the fatty matter appears in largest quantity after the absorption of chyle, although in Dr. Bence Jones' case it did not appear to be associated with any fatty condition of the blood. In Mr. Cubitt's case we may, I think, conclude that there is no organic disease of the kidneys.

First, from the absence of any symptoms.

Secondly, from the microscopical characters of the deposit; and

Thirdly, from the fact that albumen was only present when the urine contained the fatty matter.

With regard to the *treatment* of cases of chylous urine, it has been stated that the use of astringents has afforded much benefit. Gallic acid has been productive of very great relief in several, and probably in one, of permanent cure, but it is not equally applicable to all cases.

Upon reviewing the chief points in this and other cases, one is led to conclude that the condition does not depend upon any permanent *morbid* change in the secreting structure of the kidney, and that the chylous character of the urine is intimately connected with the absorption of chyle. The debility and emaciation shew that the fatty matter, albumen, and other

nutritive substances are diverted from their proper course, and removed in the urine instead of being appropriated to the nutrition of the system. Whether these materials are separated from the blood by the kidneys, or find their way to these organs by some more direct course, cannot now be decided.

Note.—Practitioners who have opportunities of examining many of these cases in the West Indies might probably afford much assistance in ascertaining the nature of this curious condition if they would make careful reports of the most marked cases. In post-mortem examinations the serum of the blood should be collected and allowed to stand, in order to see if it were milky or not. The state of the mesenteric glands, lacteals, and receptaculum chyli should be particularly examined, and it would be desirable to inject the thoracic duct, first with transparent fluid injection, and afterwards distend it with a little strong size, when the course of the absorbent trunks might be traced, and if necessary, parts subjected to microscopical examination.

REMARKS ON INJECTING HEALTHY AND MORBID STRUCTURES, AND OF EFFECTING THIS IN THE SIMPLEST MANNER.

IN the investigation of healthy and morbid structures many points of great importance can only be made out by examining injected preparations. From their extreme tenuity and perfect transparency, the capillary vessels of many tissues are not distinguishable as such in preparations examined in the ordinary way. By looking at uninjected preparations we may sometimes be led to conclude that a tissue is only slightly vascular, when it is abundantly supplied with vessels, and in other cases we may describe as a fibrous matrix or supporting frame-work, a tissue which is composed almost entirely of a dense net-work of capillaries. Capillary vessels when uninjected are often collapsed, and in the manipulation necessary for preparing a microscopical specimen, are inevitably pressed and somewhat stretched and torn. In such a specimen, the vessels cannot be distinguished from a form of fibrous or connective tissue which is very common, and in not a few instances have been so described. In investigating the anatomy of morbid growths still greater confusion has arisen from the same cause, and it is hardly to be expected that we shall be able to ascertain the nature of these, or the history of the various stages through which a particular structure passes in the

course of growth, until the arrangement of the vessels has been accurately made out, and the precise relation which the most important anatomical elements of the tissue bear to them. It is obviously impossible to ascertain these points unless the vessels are filled with some coloured material which renders them less transparent than in the natural state, and it is at the same time quite clear that they must not be filled with any opaque material, for this would prevent the possibility of the surrounding structures being seen at the same time. For investigations, therefore, of this class, the materials usually employed for injecting the capillary vessels, such as vermilion, chromate of lead, and other opaque colouring matters, are inadmissible. Neither can the tissues be dried and mounted in Canada balsam in the manner in which vascular preparations are usually preserved, because delicate structures are invariably altered or destroyed by this process.

In order to inject satisfactorily the most minute vessels of a tissue, and at the same time to demonstrate their relation to adjacent structures, one must be provided with an injecting fluid which possesses the following properties:—The fluid should be of such a consistence that it will run readily through the smallest vessels. It must contain a certain amount of colouring matter to render the arrangement of the vessels distinct, but must be sufficiently transparent to admit of the examination of the specimen by transmitted light. The colouring matter must not be soluble, for in this case it would permeate the tissues indiscriminately, and would thus prevent the vessels from being distinguished from other textures. Though insoluble, the particles of which the colouring matter is composed must be so minute as not to exhibit distinct granules when examined with the highest powers, for if this were so, the specimen would have a confused appearance. The fluid in which the colouring matter is suspended, must be capable of permeating the walls of the vessels, with tolerable facility. It must possess a certain amount of refractive power, and a density approaching to that of the fluid which surrounds the tissues in the natural condition. It must be of such composition that it may be employed without the application of heat.

The injecting fluid must not escape too readily from the numerous open vessels necessarily exposed in cutting a thin section of the tissue for examination, and particles accidentally escaping ought not to adhere intimately to the surface of the section, for this would render the specimen confused and indistinct when subjected to examination. The fluid employed must not interfere with the preservation of the specimen, and

it ought not to undergo any alteration by being kept for some time. It should be readily prepared.

The injected specimens must permit of examination with a power of at least 200 diameters.

In searching for a fluid possessing all these different properties, many experiments have been made. The fluid which I employed in my investigations upon the anatomy of the liver possesses the various qualities required, and is applicable for making minute injections of the capillaries as well as the ducts of glands. This fluid consists of Prussian blue in a state of very minute division suspended in a solution which also acts the part of a preservative fluid. The particles of blue are quite insoluble, so that they will not pass through basement membrane, but at the same time they are so minute that when examined by a very high power, the precipitate appears uniform and homogeneous. It is not easy to wash this fluid out of the vessels when a section of the injected tissue is prepared. It runs very freely. It can be kept for a length of time without being impaired, and can be used at once. Before injecting the tissue, no warming is necessary as in the use of size injections, and the preparation may be examined immediately after the injection has been completed. The fluid is inexpensive, so that small portions of an organ may be efficiently injected, in which case a considerable quantity of the injecting material must necessarily escape from the divided vessels and be wasted. It tends to harden the coats of the vessels as it passes through their channels, while at the same time it increases the transparency of the specimen. The colour is not affected by acids, but is removed by alkalies. Capillaries thus injected may be examined by the eighth of an inch object-glass.

I have given the composition of this fluid elsewhere, but as it is applicable for general purposes, and is peculiarly adapted for injecting morbid growths, I am anxious that all engaged in anatomical and pathological inquiries should test the value of this plan of preparing injected specimens, and I therefore subjoin the composition of the fluid.*

* Glycerine	1 oz.
Wood-naphtha or pyro-acetic spirit	1½ drachms.
Spirits of wine	1 oz.
Ferrocyanide of potassium	12 grs.
Tincture of sesquichloride of iron	1 drachm.
Water	4 oz.

The ferrocyanide of potassium is to be dissolved in one ounce of the water, and the tincture of sesquichloride of iron added to another ounce. These solutions should be mixed together very gradually and well shaken in a bottle, *the iron being added to the solution of ferrocyanide of potassium.* When thoroughly

Specimens injected with this preparation may be preserved in any of the ordinary preservative solutions, but I give the preference to glycerine or glycerine-jelly. They may also be dried and mounted in Canada balsam, if desired.

Lately I have succeeded in making very satisfactory injections of malignant growths, and even hard fibrous tumours, with Prussian-blue solution. I would, however, recommend the observer to inject the kidneys of the sheep or pig, the eye of the ox, frogs, and other small animals, before attempting the more difficult operation of injecting tissues in a morbid state.

ON PREPARING INJECTED PREPARATIONS OF THE LIVER FOR THE PURPOSE OF DEMONSTRATING ITS ANATOMY.

PLATES I, II, III, IV.

SINCE the publication of my paper in the Phil. Trans. for 1855, and memoir upon the anatomy of the liver,* some observers of high authority have expressed a doubt as to the possibility of forcing water through the vessels to the extent advocated in my paper, without their rupture, and the destruction of the other structures. I have, therefore, carefully repeated the plans which I followed, several times during the last year, and have in every instance confirmed the results which I previously arrived at, and have met with even greater success in preparing demonstrative specimens than before. I propose in the present paper to describe the method of proceeding, in order to demonstrate the anatomy of the liver. In this particular instance a pig's liver was operated on, but the process would be precisely the same in making injections of the livers of other animals.

Injection of the Liver with Water.—A large pig's liver within half an hour after its removal from the animal was arranged as follows. A piece of glass tube, the sharp edges

mixed these solutions should produce a dark blue mixture in which no precipitate or flocculi are observable. Next, the naphtha is to be mixed with the spirit and the glycerine, and the remaining two ounces of the water added. This colourless fluid is lastly to be slowly mixed with the Prussian blue, the whole being well shaken in a large bottle during the admixture. The tincture of sesquichloride of iron is recommended because it can always be obtained of uniform strength. It is generally called the muriated tincture of iron, and may be purchased of any chemist.—"How to Work with the Microscope," p. 18.

* On the Anatomy of the Liver, illustrated with 66 photographs of the drawings, 1856.

of which had been removed, and one end a little enlarged in the blow-pipe flame, was inserted into the *portal vein.* The vessel was tied round the tube with strong thread, all chance of slipping being prevented by the dilated extremity of the tube. A piece about 4 inches in length was inserted into the *hepatic vein* in the same manner. The liver was placed in a dish, over the edge of which the tube inserted into the hepatic vein was allowed to project, in such a way that fluid flowing from it would be conveniently received in vessels placed beneath the stool upon which the dish was supported. A quantity of water at about the temperature of 100° Fahrenheit was placed in a vessel about 4 feet above the liver. The water from this reservoir was conducted to the portal vein by means of a glass syphon and India-rubber tube provided with a stopcock. Before connecting the flexible tube with the portal vein, some of the water was allowed to flow freely through it, and permitted to gravitate into the vein in such a manner as to allow all the air contained in that vessel to rise to the orifice of the tube before the connection was rendered complete. It is very necessary to prevent air from being driven into the capillaries; for if this should happen, rupture of the vessels and extravasation of the fluid will inevitably occur. The liver having been kept warm by the application of cloths dipped in hot water, the stop-cock was turned so as to allow the water at 100° gradually to pass along the branches of the portal vein, and traverse the capillaries of the lobules. If such an arrangement be made we shall invariably notice that the entire organ soon swells to twice its size, while blood slowly trickles from the tube inserted into the hepatic vein. The blood soon becomes paler in consequence of its dilution with the water, the liver becomes tense, and the whole surface moist in consequence of the transudation of a little water; the small arteries are distended, the lymphatics are gorged, and the areolor tissue surrounding the vessels in the transverse fissure becomes puffy from the accumulation of water; bile passes along the duct, and the gall bladder becomes filled. Its contents may be forced out through the common duct by pressure. It soon becomes re-filled, and this process may be repeated many times, the fluid which is removed containing less bile each succeeding time.

The water was allowed thus to wash out the vessels of the liver, and to permeate the ducts, for about 4 hours, and the fluid collected from the hepatic vein amounted to 344 ounces. The last portions which passed through were perfectly colourless, and contained no traces of sugar, which substance had been

previously detected in considerable quantity. The liver was then removed, and injecting-pipes inserted into a branch of each of the following vessels distributed to different lobes:—*portal vein, hepatic vein, hepatic artery,* and *duct.* A pipe should also be inserted into the branch of *portal vein,* distributed to the lobe in which the duct is to be injected. While the vessels are thus distended with water branches are readily found, and the pipes can be inserted with ease. The liver was then wrapped up in soft cloths, small pieces of sponge being placed here and there, and subjected to considerable pressure during the next 24 hours, by being placed beneath a board loaded with about 15 pounds.

It is desirable only to attempt the injection of the liver during cold weather, otherwise decomposition may have commenced before the water has been sufficiently absorbed to permit the introduction of the injection into the vessels.

After the water has been absorbed, the liver is very much reduced in size, and almost of a clayey consistence. The vessels are now quite empty, and ready to receive any injection which the observer may desire to introduce. As before stated, I have tried various kinds of the ordinary opaque injections, but although these may be forced in very satisfactorily, it is absolutely impossible that the arrangements of the duct can be made out, while the smallest branches can hardly be distinguished under these circumstances, as a higher power is required for their demonstration than can be conveniently applied to the examination of an opaque injection. For these, and several other reasons, I have used transparent injections, and give the preference to the Prussian-blue solution, the composition of which is given in page 20.

Some of this injection was carefully forced into the several vessels, until the masses of liver were properly injected. It is desirable not to push the injection too far, as more is often to be learned from a partial injection than from one in which all the capillaries are completely filled.

We have, then, one lobe in which the *portal vein* is injected, another lobe injected from the *hepatic vein,* a third from the *artery,* and a fourth in which the injection has been forced into *the duct.* Of the three former, thin sections may be made after the lapse of a quarter of an hour, with a sharp, double-edged scalpel, or with Valentin's knife. These may be gently washed on both surfaces, and immersed in glycerine. After having been allowed to soak in this fluid for half an hour, or longer, they may be placed in a cell and subjected to examination.

Before, however, the arrangement of the duct can be made out, a further operation is necessary. The injection forced into the duct will pass to the smallest branches, through which it will be conducted to the cell-containing network of the lobule. It will run amongst the cells and distend the tubes of this network to such an extent that adjacent tubes will come into close contact,—the capillary, which intervenes between them, being empty, or nearly so. If a section were made, and examined, we should be able to make out nothing very definite; the duct could be traced into the lobule, and shown to be continuous with the injected portion, but the individual tubes could not be made out, or at least only one or two here and there could be demonstrated. It is obvious, that if the capillaries were injected after the duct, this difficulty would cease, and the individual tubes of the cell-containing network would be separated by an injected capillary vessel. The lobe in which the duct has been injected is therefore to be placed in water slightly warm, and the portal vein injected with perfectly clear parchment size. A pipe has already been inserted into this vessel. When the capillaries are quite filled, the pipe is closed with a cork, and the lobe placed in cold water until the size has completely set.* Thin sections may now be made in any direction, and as the lobe is very transparent, a small branch of the duct may often be followed for a very considerable distance. The sections should be preserved in glycerine. By comparing specimens from the different lobes which have been injected, the peculiar characters of each vessel will be readily made out. A rabbit's liver is very easily injected; but it is better to take one for each vessel, as the branches distributed to the different lobes are too small to receive the pipes.

After the pig's liver had been injected in the manner above-described, thin sections were examined in the microscope, and with the aid of the neutral-tint glass-reflector, their outline was traced upon transfer-paper in the manner described in page 7, and the lithographs in plates I, II, III, IV, obtained.

Plate I represents some small branches of the portal vein, just at the triangular space formed between three lobules. It will be observed, that small branches are given off from either side. These penetrate the fibrous capsules, and after reaching the interior of the lobules, gradually divide into the capillary network. The small trunks lie in the spaces between the lobules (interlobular spaces) in which also are found branches of

* For this purpose it is better to employ a mixture of size and glycerine.

the artery and duct with lymphatic vessels and nerves. These latter vessels are not to be distinguished in the present specimen because they are not injected, and being collapsed, exhibit a fibrous appearance, which, however, is exaggerated in the drawing.

Plate II represents a branch of the hepatic or *intralobular* vein, which receives the capillaries converging towards it from the circumference of the lobule. The connexion of the small trunk with the capillaries may be contrasted with that of the portal vein. It will be noticed that the capillaries open at once into the vessel upon all sides, which is the reason why these small veins always give a perfectly circular opening upon transverse section. The meshes of the network are observed to be more elongated than those at the circumference of the lobules.

Plate III shows the distribution of the arteries upon the surface of the lobules of the pig's liver. Small branches are seen in various situations, and some of these may be traced to the capillaries of the lobule into which they open, near its portal aspect, as was originally described by Kiernan, but subsequently denied by several observers.

In Plate IV are represented different portions of the duct injected. Figs. 3 to 6 show the mode of ramification of the ducts upon the surface of the lobules. These drawings are only magnified 45 diameters.

Fig. 1 shows a few branches of a small duct, and a portion of the cell-containing network. At *a*, the small duct is seen to expand, as it were, to form the wide tube of the cell-containing network which is continued throughout the lobule, and in which the liver-cells lie. Several cells have been figured. The walls of these smallest ducts are composed of a delicate basement-membrane only, but the single layer of epithelium can sometimes be distinguished even in the injected specimens, as at *c*.

In the process of injection, the small ducts and the tubes of the cell-containing network into which injection happens to run, inevitably become distended to many times the diameter which they have in the natural state. By the distension of some of the small branches, the injection is prevented from entering others, so that even in a successful injection, we must not expect to find every branch of a small duct injected. The injection entering the cell-containing network at *a*, has accumulated there to some extent, and thus separated the cells from each other. Upon comparing this drawing with plate I, it will be observed that the tubes of the network are much too large to lie in the meshes of the portal capillaries; but this

arises merely from the undue distension to which they have been subjected. Although a good deal of injection has entered the tubes delineated in fig. 2, it will be found that this would adapt itself pretty well to the capillary network. Both drawings are magnified 130 diameters. If in the course of injection much force has been applied, this accumulation of the injection in the smallest ducts and most external portion of the cell-containing network, would take place to such an extent as to force adjacent tubes, into which injection has passed, into close contact; and thus a nearly uniform mass, in which no separate tubes can be seen, results. This confused appearance, however, can readily be distinguished from extravasation, and with a little practice, the observer will be able to obtain many demonstrative sections from a liver which has been injected successfully, exhibiting the characters above described. The best plan, however, of making preparations of this kind, is to inject the capillaries with plain size, in the manner described in page 24, after the duct has been injected.

LOBULES OF THE LIVER, OX.—PORTAL AND HEPATIC VEINS INJECTED.

PLATES V, VI.

THESE drawings illustrate the general arrangement of the lobules of the liver of the ox, which is very similar to that met with in most mammalian animals. The specimens were only partially injected. The dark parts of the drawing show the injected capillaries. The pale rough parts represent portions of the lobule, the capillaries of which are not injected.

PLATE V is a copy of a preparation in which the portal vein was injected with transparent blue injection, and plate VI represents a specimen in which the hepatic vein had been injected in a similar manner. Both sections were obtained with Valentin's knife, and have been preserved in glycerine. The examination was made by transmitted light, and the drawings were traced with the aid of the neutral-tint glass reflector.

The specimens are magnified fifteen diameters. In the first plate the lobules are seen to be imperfectly mapped out by the disposition of the capillaries injected from the portal vein,

but it will be observed that the lobules for the most part are not separated from each other by a distinct line of demarcation, as in the pig, but the capillary vessels of one imperfectly circumscribed space or lobule communicate pretty freely with those of the lobules immediately adjacent. The smaller branches of the vein lie in fissures between the lobules and give off branches on all sides. These *branches* never anastomose as some authors have described, but communicate with each other only through the intervention of capillary vessels. As may be seen by examining the plate, the capillaries of one lobule communicate with those of adjacent lobules; so that when the marginal capillaries of several lobules are only partially injected, we observe a number of rings enclosing clear spaces into the capillaries of which the injection has not extended.

The disposition of the hepatic vein in plate VI appears at first sight somewhat similar. I have had these plates arranged face to face in order that the comparison may be made more readily. Although it may be said generally that a small branch of the vein commences in the central part of each lobule and receives capillaries which converge towards it, the preparation shows that the capillaries which belong, as it were, to one branch, communicate here and there with those of adjacent branches, so that in an injected preparation an appearance not altogether unlike that represented in plate V, in which the portal vein is injected, is produced. It would be difficult in looking cursorily at these preparations to say in which the portal vein, and in which the hepatic vein, had been injected. In each case, spaces seem to be imperfectly mapped out by the disposition of the injected vessels. Upon more minute examination, however, the difference will be easily made out and it will be observed,—

First, that where the hepatic vein has been injected, the small trunk in the central part of the lobule in many instances has been cut across and remains open, because the capillaries are continuous with the vessel on all sides. The divided vein is shewn by a clear and almost circular opening, in consequence of the injection having escaped in preparing the specimen, plate VI *b*.

Secondly, fissures may be observed in the uninjected portions, some of them of considerable extent, *a*.

Thirdly, where the portal vein was injected, these fissures, plate V *a*, are bounded on either side by injected capillaries, and contain a small branch of the portal vein which also appears clear from the escape of injection. The divided hepatic vein is seen in the centre of the uninjected space, *b*. The two points upon which we may depend for ascertaining which is the centre

and which the circumference of the lobule are,—the circular opening of the divided hepatic vein which is always in the centre,—and the fissures in which lie branches of the portal vein, hepatic artery and duct, and which are situated in the intervals between the lobules. To see these points distinctly it is better to make a very thin section, wash it carefully, place it on a glass slide, and hold it up to the light. The question cannot always be determined by examining the liver in the ordinary manner. Since it has been shown to be so difficult to distinguish between the centre and circumference of the lobules in an injected preparation, it is not surprising that without great care mistakes should arise in examining uninjected specimens; and not unfrequently, the centre has been described as the circumference of the lobule, and the circumference as the centre; whence great confusion has occurred in making use of the terms *portal* and *hepatic venous congestion.* I propose to consider the subject of congestion of the lobules of the human liver in a separate paper.

Now from the intimate communication between the several small branches of the portal veins through the intervention of capillary vessels, it is possible that blood passing along a small branch of portal vein should reach the lobule and travel by a circuitous route through the portal capillaries of several lobules, before it is carried off by the hepatic vein; but when we consider that blood is poured into the capillaries upon all points of the circumference of the lobules such an arrangement would necessarily tend to cause a flow towards the centre of each lobule, and the blood would thus be carried off in the most direct manner. Supposing, however, obstruction to occur in certain branches of the vein distributed to the lobules; by reason of this arrangement the capillaries of these lobules would still be supplied with blood,—the functions of the secreting structure would still be carried on,—and the disorganization of the lobule effectually provided against.

This arrangement is one which favours the free distribution of the blood to the numerous minute elementary parts of which this solid organ may be said to be composed, while the circulation in each individual portion is rendered equable, and in case of any limited derangement in a particular lobule, an undue rush of blood towards the adjacent lobules is prevented.

The structure of the human liver in the respects above alluded to, is very similar to that of the ox.

CYSTS IN THE LIVER.

PLATES VII, VIII.

CYSTS are met with less frequently in the liver than in most other organs. Various theories with reference to the development of cysts have been propounded by different authorities, but no single view will account satisfactorily for the production of cysts in all cases, and it may be regarded as certain that cysts may be produced in several different ways.

Case I.

Small Cysts in the Secreting Structure of the Lobule of the Liver. Obstruction of the common Duct, caused by the Growth of an Epithelial Structure at its Orifice.

The liver was taken from the body of a man, aged 53, who died in King's College Hospital. It was everywhere of a very dark yellow colour, and throughout every part of it the ducts were enormously dilated. When a section was made, the area of the divided ducts was seen to be many times larger than that of the branches of the portal vein. The small ducts in the interlobular fissures varied from three to eight or ten times their normal diameter. This great dilatation of the ducts was found to be caused by an obstruction situated close to the orifice of the common duct. Upon examination, a small eminence was discovered projecting from the surface of the mucous membrane. It presented to the unaided eye, the general characters of *encephaloid cancer*. Upon more careful examination, however, it was found to be composed of numerous plaits or lamellæ, covered on both their surfaces with columnar epithelium. This structure was very peculiar, and I had never seen anything like it before. Vessels were observed in the walls of the lamellæ, the contiguous surfaces of which were covered with epithelium. This mass had doubtless grown very gradually, and the dilatation of the ducts must have extended over a considerable period of time. The specimen was kindly sent to me by Dr. Budd.

Upon making thin sections in various parts of this liver, numerous very small cavities or spaces with sharp outlines were observed. When examined under a power of 20 diameters, the sections presented the appearances copied in fig. 3, plate VIII. The secreting structure was everywhere of a dark yellow colour. The tubes of the network seemed to have been stretched and compressed. The little spaces were of two kinds, —one evidently resulting from the division of a tube at right

angles,—the other clearly consisting of portions of small, round cavities. The former were proved to be small branches of the duct, much dilated, and thus served to mark the situation of the interlobular spaces. The latter were situated in the lobules themselves, and in some instances doubtless communicated with the ducts. They might be described as cavities, connected with the narrowest portions of the ducts, many of which, in the natural condition, commence below the surface of the lobule, or, in other words, become continuous with the cell-containing network after passing a short distance within the lobule.*

It seems to me, that these spaces have been formed thus.—The ducts have become dilated very gradually up to their narrowest portions in the interlobular fissures, where their walls consist of basement membrane alone,—and perhaps, in some instances this process may have extended to the tubes of the cell-containing network. In many situations these bulgings had proceeded to the extent of rupture, in which case the contents would have escaped amongst the meshes of the cell-containing and vascular networks. Under these circumstances, it is reasonable to conclude that the network immediately adjacent would have been stretched, much of it destroyed, and no doubt gradually removed by absorption; while here and there a tube might be considerably stretched, but not to such an extent as to be completely destroyed. If this were the case, we should expect to find, here and there, passing from one side of the cavity to another, narrow tubes filled with altered cells. In figs. 1 and 2, such tubes containing much yellow colouring matter, and oil globules, are represented. These drawings were carefully copied by myself, with the aid of the neutral-tint glass reflector, from preparations in my possession, which still show these points very distinctly. The appearances are to me very interesting, as they form additional evidence in favour of the existence of a network which contains the cells, distinct from the vascular network in which the blood circulates. I cannot account for the appearances observed in these preparations in any other manner. No cells at all resembling those of the healthy organ could be detected in this liver; but there was much granular matter, irregularly-shaped masses of colour-

* Some of the ducts are connected with the most superficial portion of the cell-containing network, but others plunge into the lobule, and after running for a short distance into the meshes of the cell-containing net-work, become continuous with some of the tubes in the lobule situated in its outer part, but nevertheless beneath the surface, and some distance from the interlobular fissures.—" On the Anatomy of the Liver, illustrated with 66 photographs of the drawings."

ing matter, and much coloured material in a very minute state of division.

Case II.

Cysts in the Liver of a Man aged 53, *associated with a similar condition of the Kidney.*

A liver weighing four pounds and six ounces, containing numerous cysts in every part, which varied in size from mere points up to the size of a pigeon's egg, was exhibited at the Pathological Society, in 1856, by my friend Dr. Bristowe, who kindly sent me a portion of this liver for examination.*

The liver was taken from the body of a shoemaker, aged 53, who was admitted into St. Thomas's Hospital in a very low and feeble state, and died two days afterwards. His health had been good till within ten weeks before his death, when he was attacked with severe pain in the epigastrium and right side, supposed to depend upon pleurisy. The urine became bloody five weeks after the commencement of his illness, and continued so up to the time of his death. Dr. Bristowe could only obtain this somewhat unsatisfactory history of the case. The kidneys were enormously enlarged, and also contained numerous cysts —"one kidney weighed two pounds seven ounces and a quarter, and the other two pounds and three-quarters of an ounce."

I did not obtain a portion of the liver until it had been removed from the body for some days, and I only attempted to ascertain the precise locality of the cysts, and, if possible, their mode of formation. The characters of the walls of the cysts, and their contents, have been fully described by Dr. Bristowe in his report. I injected a large branch of the duct with the Prussian-blue fluid†, and the portal vein with plain size. The portion of liver was then placed in cold water until the size had set perfectly. Thin sections were now made in different directions, with the aid of Valentin's knife,—soaked for some time in glycerine, and subjected to examination. In this manner thin sections of several cysts were obtained without difficulty.

The lining of the larger cysts was smooth, while that of the smaller ones was rough and irregular, and appeared to be formed by the tissue of the liver itself. Liver cells were here

* A description of the general characters of the cysts, of the condition of the liver, and of other organs, will be found in Dr. Bristowe's report, in the seventh volume of the "Transactions of the Pathological Society of London," p. 229. Dr. Wilks also describes a preparation in Guy's Hospital Museum of this very uncommon disease of the liver, in page 235 of the same volume.

† See p. 20.

and there observed in this situation, but for the most part the layer forming the immediate boundary of the cavity, when examined by a power of 130 was found to be granular, with a few scattered oil globules.

In some places, the blue injection had passed from the ducts into the cysts, but as the duct always lay on one side of the cyst, there could be no doubt that this resulted from rupture of the walls of the duct and intervening tissue, and extravasation into the interior. Although in many cases the larger cysts were close to the portal canals, the smallest were situated in the interior of the lobules, and in some instances nearer the centre than the circumference.

The injection had traversed the ducts satisfactorily. Their walls were even, and their calibre not greater than in health. (Plate VII, fig. 2 *e*; plate VIII, fig. 5). In no single specimen could I make out the slightest tendency to dilatation of their coats, and after the examination of very numerous specimens, I concluded that the theory which accounted for the formation of cysts by obstruction of the duct at a particular point, and the accumulation of secretion behind, must be rejected in this instance.

Upon carefully comparing many of the specimens together, it was observed that the cell-containing network of the lobule was much more lax in some situations than in others, the meshes in which the capillary vessels were situated were very wide, while the tubes of the network were narrow and seemed to have been much stretched.* In some places, the cell-containing network seemed to be reduced to a delicate fibrous web, the meshes of which were occupied with a clear fluid. These clear spaces were usually situated about midway between the centre of the lobule and its portal aspect. (Fig. 1, plate VII, *a*.)

In this case, then, the cysts appear to have originated in the meshes of the cell-containing network of the lobule. It is impossible to account for their origin; but we may suppose that in consequence of some morbid change in the parts, fluid was

* The *lobule* of the liver of vertebrate animals consists of two tubular networks, which are mutually adapted to each other. In one of these (capillaries) the blood circulates. In the other (cell-containing network) the liver-cells lie. At the circumference of the lobule, the *former* is continuous with the smallest branches of the portal vein, and receives blood from minute branches of the hepatic artery; the whole of this blood being carried away by a small branch of the hepatic vein situated in the centre of the lobule. The *latter* at the circumference of the lobule is continuous with the smallest ducts, while in the centre it forms a looped arrangement towards the hepatic vein. In the *first*, the blood flows from the circumference towards the centre. In the *second*, the bile escapes from the cells, and passes from the centre towards the circumference of the lobule, and is carried off by the duct.

effused between the capillaries and the cell-containing network, the latter becoming stretched, and its nutrition in consequence impaired. The fluid would increase in proportion until a small cavity with numerous altered tubes and attenuated capillaries was formed. The walls of this cavity were formed in the first instance merely by the hepatic tissue itself, but gradually, no doubt, material might be deposited which would become converted into a form of fibrous tissue, the internal surface of which would at length become invested with lining membrane covered by a delicate epithelial layer.

The drawings in plate VII illustrate the remarks just made. In fig. 1 the tubes of the cell-containing network are much narrower than those in fig. 2, which is taken from another part of the same liver where the cells present their ordinary characters, and exist in considerable number. In plate VIII, fig. 6, a small portion of the network, more highly magnified, is shown, in which the outline of the tubes is very distinctly seen.

At *a*, fig. 1, a very small cyst in process of formation is represented, and it will be observed that very few cells are visible; *b* is the margin of the lobule towards a small portal canal. In fig. 2, *c* is a small branch of the *intralobular* or hepatic vein, *d*, an interlobular space, and *e* a small gall-duct lying in the space.

One would be led to conclude from these observations that cysts in the liver may be formed in at least three ways:

1. By obstruction of a branch of a duct, and by accumulation of secretion behind the obstructed part.

2. By the gradual dilatation, caused by the obstruction of a large duct, extending backwards to the smallest ducts, even to the point where they become continuous with the cell-containing network of the lobule. The thin walls at length giving way, extravasation would take place amongst the vascular and cell-containing networks. Under these circumstances the duct would gradually become obliterated, while these little cavities might remain in the form of closed cysts.

3. By a gradual alteration occurring in a portion of the secreting structure within the lobule, leading to the deterioration of some of the meshes of the vascular and cell-containing networks, and the gradual pouring out of a serous fluid to occupy the place of the wasted structures.

There are other theories with reference to the mode of formation of cysts generally than those above alluded to, and it may be well just to advert cursorily to the most important of these.

Rokitansky considers that a cyst at the earliest stage of its

development really consists of a cell, which absorbs nutriment from the surrounding tissues, and gradually increases in size.

Bruch, on the other hand, holds that the contents of the cyst are first formed, being deposited in the substance of various organs and tissues, and that the wall of the cyst is formed around them.

In the second case reported the walls of the cyst were, no doubt, a secondary formation. It seems most probable that the first change which occurred was shrinking of the secreting structure of the liver, followed by effusion of serum to occupy the vacant space. Then further alteration of the cell-containing network, and gradually its complete disappearance in this situation. The ragged walls of the cavity afterwards became condensed, and were at length lined with an imperfect lining membrane.

ON THE ESTIMATION OF UREA, CHLORIDES, SULPHATES, PHOSPHATES, AND SUGAR IN URINE VOLUMETRICALLY.

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*** In this paper weights are expressed in grammes and grains, and measures in cubic centimeters and grains; the grammes, gr., and cubic centimeters, C.C. being always placed before the grains, grs. Thus, ·01 gr. = ·154 grs. is to be dissolved in 1 C.C. = 15·44 grs. of water.

I HAVE been requested by Dr. Beale to write a short paper on the quantitative determination of certain constituents of the urine according to the volumetric method, for which purpose I have just now prepared in his laboratory some graduated solutions. I will first describe the plan itself, and then refer to the method of preparing the solutions.

The following is the principle upon which this method of analysis is based. As all chemical compounds are formed in certain definite proportions, and a specific quantity of a body requires for its precipitation a certain definite proportion of a reagent, we shall find the proportion of the unknown substance present, if we ascertain the quantity of the reagent required to neutralize it completely. Now the equivalent number represents the proportion in which bodies combine. To fulfil the

other condition it is only necessary to make a solution of the reagent of a certain definite strength, and pour it from a graduated glass, so that we may know the exact quantity we use. For instance, suppose the quantity of sulphuric acid (SO^3) in a solution is to be determined. We know that to precipitate 40 parts of sulphuric acid, exactly 122 parts of crystallized chloride of barium ($Ba\ Cl + 2HO$) are required,—or for 1 part of sulphuric acid, 3·05 parts of chloride of barium,—or for ·01 gramme = ·154 grain of sulphuric acid, ·0305 gr. = ·747 gr. of chloride of barium. Now if we dissolve 30·5 gr. = 471·04 gr. of chloride of barium in 1000 Cubic Centimeters of water = 15444 grs. or about $1\frac{3}{4}$ pint, every Cub. Cent. contains ·0305 gr. = ·47 grs. of chloride of barium; and if we place this solution in a tube graduated to *Cubic Centimeters* or *grains,* and allow it to flow gradually into a solution of sulphuric acid as long as we get a precipitate, the number of Cub. Cent. used indicates the quantity of *chloride of barium* employed, and from these data we at once ascertain the proportion of *sulphuric acid* contained in the solution.

The advantage of this method is evident.

First, it takes very little time to perform an analysis. Instead of precipitating, filtering, washing, drying, igniting, and weighing, the solution having been prepared, it is only necessary to notice how much is required to neutralize all the sulphuric acid present; and an analysis that formerly required days for its performance, is now finished in as many quarters of an hour.

Secondly, the performance itself is very simple, an acquaintance with complicated chemical operations is not necessary, and it may therefore be undertaken by those who are not skilled in the ordinary processes of chemical analysis.

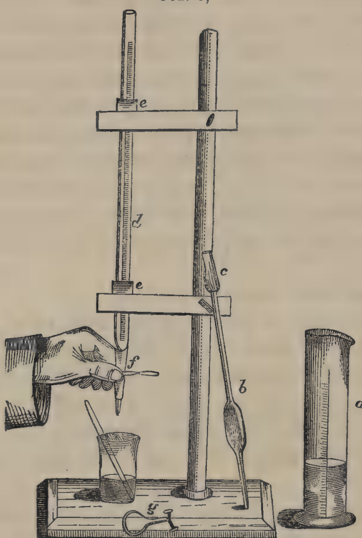
By this process it is quite practicable for physicians who have little time at their disposal, to determine very readily, and with accuracy, the quantities of those constituents of the urine which it is of importance to estimate in cases of disease.

APPARATUS REQUIRED.

1. *Burettes or graduated tubes,* fig. 1. *d.* It is convenient to be provided with one or more containing 50 Cub. Cents., and graduated to half Cub. Cents. The lower part of the tube is drawn to a small calibre, and to its extremity a small piece of glass tube about 2 inches long, is connected by a piece of India-rubber tube, *f,* so arranged that it can be compressed at pleasure by a wire-spring, as represented in the figure. When the two

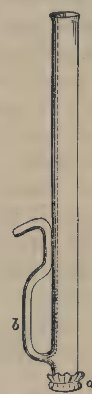
extremities of this spring are pressed by the finger and thumb, fluid will flow down the tube, and when the pressure is removed, the tube is rendered impervious. This little apparatus serves the part of a stop-cock, and possesses many advantages over the latter. Care must be taken to keep the tube perfectly clean, and the India-rubber should be removed and well washed after every analysis.

FIG. 1,



Apparatus required for the volumetric method of analysis. *a.* A glass jar capable of holding 500 C.C. graduated to five C.C. *b.* A pipette graduated to hold 20 C.C. *c.* A piece of India-rubber tube for the convenience of allowing the fluid to escape very slowly when pressure is applied by the finger and thumb. *d.* The burette capable of holding 50 C.C. and graduated to half C.C. The numbers are not marked on the tubes in the figure. *e.* Small pieces of wide India-rubber tube to hold the burette in its place. *f.* Small piece of India-rubber tube connecting the extremity of the burette with the spout, and capable of being compressed by the spring, the form of which is represented at *g.* The mode of using the apparatus is seen in the figure.

FIG. 2.



Dr. Beale's tube for filtering small quantities of the solution in order to see if the whole of the substance in solution has been precipitated. The small tube *b.* is curved as shown in the figure in order to prevent a drop of the unfiltered fluid from running down the outside as the filtered solution is poured through the spout. Rather less than one half the real size.

2. *Pipettes.*—The pipette is figured at *b* fig. 1. It is convenient to be furnished with one of 20 C.C. = 308·88 grs. capacity, one of 15 C.C. = 231·66 grs. and one of 10 C.C. = 154·44. grs.

3. *Cylindrical glass-measure,* graduated to 500 C.C.

4. The little apparatus represented in fig. 2 was constructed by Dr. Beale for the purpose of filtering a little of the fluid

from the deposit, in order to see if all the substance was precipitated. Filtering paper is tied round the lower extremity *a*. By plunging this beneath the fluid, the solution rises quite clear in the interior, and may be poured through the spout *b* into a small test-tube kept for the purpose.

In estimating the quantity of sugar, this will be found very convenient.

5. Beakers, stirring-rods, test-paper, funnels, and porcelain basins, with a tripod or small retort-stand, with a spirit-lamp or gas-lamp and small sand-bath, are also required.*

I must mention a few circumstances which it is important to observe in this method of analysis.

First, as to filling the burettes. The test-solution is poured in at the top till it is nearly full. A beaker is then placed beneath the orifice and a certain quantity of fluid allowed to flow from the tube until the upper surface reaches zero on the scale. The line on the burette should always correspond to the lowest part thick line at the top of the fluid, caused by the capillary attraction of the walls of the tube. Care must be taken that the part of the tube below the India-rubber joint is also quite full of fluid.

Secondly. With reference to the pipettes, it is convenient that they should be provided at their upper extremity with a short piece of India-rubber tube, *c* fig. 1, as by properly applied pressure of the finger and thumb upon this, the fluid may be allowed to escape very gradually.

The mode of proceeding in estimating the proportion of some of the constituents of the urine may now be described.

ESTIMATION OF UREA AND CHLORIDES.

The determination of the urea and chlorides is effected by solutions of pernitrate of mercury ($HgO.NO^5$). The principle of this method is, that *chlorine* gives a soluble, and *urea* an insoluble, compound with peroxide of mercury (HgO), and that chlorine has a greater affinity for mercury than urea has; therefore, if we add pernitrate of mercury ($HgO.NO^5$) to a solution containing chlorine and urea, the chlorine will first combine with the mercury, and we shall not get a precipitate of urea and mercury until all the chlorine has been saturated, and if we observe how much of the solution has been used before a precipitate occurred, we learn at once the quantity of chloride

* The apparatus referred to may be obtained of Mr. Griffin, Bunhill Row, who also supplies the test-solutions.

present; and the volume of the solution required for completing the precipitation, shews the proportion of urea, as will be explained presently. The same solution however is not used for both these determinations, as for convenience in reckoning it is better they should be of different strength. In both cases it is necessary in the first instance to remove the phosphates from the urine. In order to effect this we must prepare a mixture of 1 volume of a cold saturated solution of nitrate of baryta ($BaO.NO^5$) and 2 volumes of saturated baryta-water ($BaO.HO$). This we will call the *baryta-solution.*

1. Determination of Urea ($C_2H_4N_2O_2$).

Preparation of the Solution.—If pure mercury is procured, 71·48 gr. = 1103·93 grs. are dissolved in pure nitric acid with the aid of the heat of a sand-bath. When fumes of nitrous acid (NO^3) cease to be evolved and a drop of the solution gives no precipitate with chloride of sodium ($NaCl$), it may be evaporated on a water-bath in the beaker in which it has been prepared, to the consistence of a syrup. This, lastly, is diluted so as to obtain a volume of 1000 C.C. = 15444·00 grs. or about $1\frac{3}{4}$ pints, adding a few drops of nitric acid (NO^5) as often as the solution becomes turbid, which will render it clear again.

If the mercury of commerce is used a somewhat larger quantity of it is treated with nitric acid as before, but the process is stopped before it is completely dissolved: it is allowed to cool, when crystals of protonitrate of mercury ($Hg_2O.NO_5$) will form. The crystals are thrown on a filter and washed with a little nitric acid. They are to be boiled with nitric acid, till no more vapours of nitrous acid are given off, and no precipitate occurs, when a little is dropped into a solution of chloride of sodium. By evaporating a solution to the consistence of a syrup, pure pernitrate of mercury ($HgO.NO^5$) is obtained. This is diluted, but less water added than the solution will probably require. The proportion of mercury it contains is estimated either by sulphuretted hydrogen or potash; and lastly it is diluted, so as to contain ·772 gr. = 11·92 grs. of peroxide of mercury (HgO) in 10 C.C. = 154·40 grs.

1 C.C. = 15·44 grs. of this solution, made according to either of the above methods, indicates 0·01 gr. = 0·154 grs. of Urea.

Performance of the Analysis.—In the first place one takes 40 C.C. = 617·76 grs. of the urine and mixes them with

20 C.C. = 308·88 grs. of the baryta-solution: the precipitate is filtered and 15 C.C. = 231·66 grs. of the filtrate are placed in a small beaker. These 15 C.C. contain 10 C.C. of urine. The burette is next filled with the solution, which is added as long as the precipitate is observed to increase. Then the following test is to be applied to ascertain if a sufficient quantity has been added. A drop of the mixture is removed with a glass-rod and placed on a watch-glass. A drop of a solution of carbonate of soda ($NaO.CO^2$) is then placed near the first, and the two drops are allowed to flow together. If they give a white precipitate, the process is not yet finished, more of the mercury-solution must be added, and a drop tested as before, till the two drops when flowing together give a yellow precipitate, which shews an excess of mercury. A second experiment may be made to confirm the first, and lastly by reading the number of C.C. required, the quantity of urea contained in the urine is immediately ascertained. Still there is a correction to be made: the first drops of the solution which produced no precipitate did not combine with, and do not therefore shew the urea present. This volume must be deducted. For this purpose two cubic centimeters may always be subtracted from the volume of the test-solution used.

2.—Determination of Chloride of Sodium (NaCl).

Preparation of the Solution.—17·06 gr. = 263·47 grs. of pure mercury are dissolved as before described and the syrup diluted to a volume of 1000 C.C. = 15444·00 grs., or about $1\frac{3}{4}$ pints, as in the last case. Or the solution of pernitrate of mercury ($HgO.NO^5$), made from the impure mercury, which has been analyzed, is diluted in the proportion, that 10 C.C. of it may contain ·184 gr. = 2·84 grs. of peroxide of mercury (HgO).

1 C.C. of this solution answers to ·01 gr. = ·154 grs. of chloride of sodium.

Performance of the Analysis.—40 C.C. = 617·76 grs. of urine are mixed as before with 20 C.C. = 308·88 grs. of the *baryta-solution*; 15 C.C. = 231·66 of the filtered mixture are placed in a beaker and rendered acid by a few drops of nitric acid. The burette is filled with the test-solution, which is allowed to drop into the beaker, the mixture being continually stirred with a glass-rod. As soon as the precipitate at first formed, does not disappear by stirring, the operation is finished, and the volume of the solution required is read off. This shows the quantity of chloride of sodium contained in the urine.

With regard to removing the phosphates,—in both cases, it is to be remarked that if 1 part of the *baryta-solution* to 2 parts of the urine should not precipitate the whole (a point easily ascertained by adding some of the baryta-solution to a few drops of the filtered mixture), more of the baryta-solution must be added. This then would somewhat modify the quantity of the mixture to be taken for the test. Suppose it is desired that it should still contain 10 C.C.=154·44 *grs.* of urine in it. 17½ C.C.=270·27 *grs.* of the mixture would be required, if there are 3 parts of baryta-solution to 4 parts of urine; 20 C.C.=308·88 *grs.* would be taken, if there are equal parts of baryta-solution and urine. More than this will hardly ever be required.

3.—Determination of the Sulphuric Acid.

Preparation of the Solution.—A quantity of crystallized chloride of barium is to be powdered, and dried between folds of blotting-paper. Of this, 30·5 *gr.* = 471·10 grs. are to be dissolved in 1000 C.C.=15444·00 of distilled water.

A dilute solution of *Sulphate of Soda* is also required.

Performance of the Analysis.—100 C.C.=1544·4 *grs.* of the urine are poured into a beaker, a little hydrochloric acid added, and the whole placed on a small sand-bath, to which heat is then applied. When the solution boils, the chloride of barium test is allowed to flow in very gradually as long as the precipitate is seen to increase distinctly. The heat is removed, and the vessel allowed to stand still, so that the precipitate may subside. Another drop or two is then added, and so on, until the whole of the SO^3 is precipitated. Much time however is saved by using the little apparatus represented in fig. 2. A little of the fluid is thus filtered clear, poured into a test-tube and tested with a drop from the burette; this is afterwards returned to the beaker, and more of the test-solution added if necessary. The operation is repeated until the precipitation is complete. In order to be sure that too much of the baryta solution has not been added, a drop of the clear fluid is added to the sulphate of soda placed in a test tube. If no precipitate occurs more *chloride of barium* must be added; if a slight cloudiness takes place, the analysis is finished, but if much precipitate is produced, too large a quantity of the test has been used, and the analysis must be repeated.

For instance, suppose 27 half-cubic centimetres=208·49 *grs.*, have been added, and there is still a slight cloudiness produced, which no longer appears after the addition of another half-cubic

centimetre = 7·722 *grs.* of the solution, we know that between 27 and 28 half-cubic centimetres are required to precipitate the whole of the sulphuric acid present, and 100 C. C. = 15444·00 of urine contain between ·135 and ·14 gr. = 2·085 and 2·162 *grs.* of *sulphuric acid.*

4. Determination of the Sugar.

This method is deduced from the reaction occurring in employing Trommer's test for grape-sugar. It is well known that grape, or diabetic sugar, possesses the power of reducing the oxide of copper to the state of yellowish-red suboxide.

Preparation of the Solution.—An alkaline solution of sulphate of copper is prepared with the aid of *tartaric acid* and *potash.* The former prevents the precipitation of the oxide of copper by the potash. 40 gr. = 617·76 *grs.* of cyrstallized sulphate of copper are dissolved in about 160 C.C. = 2471·04 of water. Next 160 gr. = 2471·04 *grs.* of neutral tartrate of potash are to be dissolved in a little water, and from 600 to 700 gr., about 9500 *grs.* of a solution of soda of 1·12 sp. gr. are to be mixed with it. The solution of the sulphate of copper is added gradually, and the whole diluted with water to a volume of 1154·4 C C. = 17828·5 *grs.*; 10 C.C. = 154·4 *grs.* of this solution correspond to ·05 gr. = 772 *grs.* of sugar.

Performance of the Analysis.—10 C.C. = 154·4 grs. of the copper solution are diluted with 40 C.C. = 617·7 grs. of water and placed in a porcelain dish. About 20 C.C. = 308·8 *grs.* of the urine are diluted with from 10 to 20 times its bulk of water, so as to produce, for instance, 300 C.C. = 4633·2 grs. This is to be poured into the burette and adjusted so as to fill it to the 0° of the scale. The dish with the copper solution is arranged on a sand-bath placed on a tripod stand, at a convenient distance beneath the orifice of the burette. A spirit or gas-lamp is applied until the copper solution approaches the boiling point, when the urine is allowed to flow in gradually, until suboxide of copper ceases to be precipitated, and the solution no longer possesses a blue colour. This is ascertained by removing the lamp and allowing the deposit to settle, when the blue tinge may be observed if the whole has not been precipitated by tilting the basin a little and observing the colour of the clear fluid as it flows against the white porcelain. Dr. Beale's little filtering apparatus will also be found of value in this operation, and its employment will save time. If the solution has still a blue tinge more urine is to be added, and the mixture again boiled for a minute. This operation is to be

repeated as long as any unreduced oxide remains in solution. When the process is finished the proportion of sugar contained in the urine is easily calculated.

Suppose 24 C.C. = 370·6 *grs.* of the diluted urine have been required to reduce the 10 C.C. = 154·4 *grs.* of the copper solution, these 24 C.C. contain ·05 gr. = ·772 *grs.* of sugar. But since 300 C.C. of the dilute solution contain only 20 C.C. = 308·8 grs. of the urine, the 24 C.C. contain only 1·6 C.C. = 24·7 *grs.* Therefore 1·6 C.C. = 24·7 *grs.* of urine contain ·05 gr. = 0·772 *grs.* of sugar, or in 100 C.C. = 1544·4 grs. of urine 3·12 gr. = 48·18 *grs.* of sugar are present.

(*To be continued.*)

CHEMICAL AND MICROSCOPICAL EXAMINATION OF MORBID SPECIMENS.

CHOLESTEATOMA.

TUMORS of this description are very rarely met with. Their anatomical characters were first described by J. Müller. Those referred to by him and later authors were in connexion with the brain and its membranes, and the two cases brought forward in this communication, are the only instances of true cholesteatomatous tumors occurring in other parts of the organism which I can find recorded.

Case I.

Contents of a large Tumor situated over the Trochanter-major of a Woman. Removed by Mr. Simon.

The tumor had been growing about fifteen years, and had attained a large size. Mr. Simon made an incision into the tumor and squeezed out the contents, which he sent to me for examination.

The portion examined consisted of a dirty brown, soft, pulpy mass, with a strong odour, closely resembling that of fæces. Interspersed through it were numerous thick micaceous plates, like fish-scales, but thicker. These plates were very easily separated into a number of thinner scales. In its general appear-

ance, the mass much resembled the residue at the bottom of anchovy bottles.

The capsule presented the usual characters of such structures, being composed principally of white fibrous tissue, with vessels.

Chemical Composition.—151·29 grs. of the pulpy mass were examined, and the per-centage composition was as follows :—

		In 100 parts of solid matter.
Water	87·78	
Solid matter	12·22	
Extractive soluble in water and alcohol	3·119	25·52
Extractive soluble in water only	1·030	8·44
Fixed alkaline salts, consisting of sulphates, chlorides, phosphates, carbonates, with a trace of iron.	·396	3·24
Fatty matter	·053	·43
Albuminous matter insoluble in boiling water	6·999	57·27
Earthy salts, consisting of phosphate and sulphate of lime	·608	4·97

The extractive matter soluble in alcohol, had the same peculiar smell as the mass itself. The odorous material was volatile, and was present in the fluid which passed over in distillation in considerable quantity. The fatty matter was treated with alcohol, but no cholesterine crystallized out, probably in consequence of being protected from its action by the hard fat present. The total quantity of fatty matter was so small that no further experiments could be resorted to. It should be borne in mind, that an amount of cholesterine which when examined in the microscope would be accounted considerable, is often so small as not to be appreciable by the balance.

The pearly scales were carefully separated from the remainder of the mass, and well washed in water. They were scarcely altered by the action of several chemical reagents with which they were treated.

1. Boiling water exerted no change.

2. Alcohol dissolved out a very small quantity of matter, consisting principally of cholesterine.

3. Ether extracted a trace of very hard fat.

4. The vesicles of which the flakes were composed shrunk a little when acted upon by boiling liquor-potassæ, and a few oil globules were developed upon their surface.

5. When boiled with acetic acid, they became more transparent, and the outline more delicate; at the same time, a few dark spots made their appearance round the margin of the vesicles.

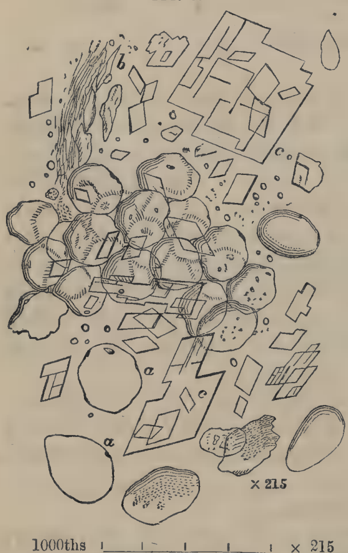
6. No change was produced by the action of strong nitric or hydrochloric acids.

7. Some of the scales were left for months in a little water, and although all the other constituents of the mass putrefied, these underwent no change.*

Microscopical Examination.—The mass consisted of two portions which may be described separately. 1. Dark brown pulpy matter, which appeared amorphous when examined with low powers. 2. The pearly scales above-alluded to, resembling fish-scales when examined by the unaided eye.

1. *The brown pulp* was found to consist of numerous crystals of cholesterine (*c*, fig. 3), scaly particles, probably cholesterine imperfectly crystallized, free oil globules, a few cells with dark granular contents, free granular matter, a few blood-corpuscles, and many of the separated vesicles described below.

FIG. 3.



Cholesteatoma.—*a*. Large cells, of which the laminæ forming the pearly scales were composed. Some of these are shrivelled and flattened, resembling the superficial scales of the epidermis. *b*. Fibrous tissue from the inner surface of the capsule. *c*. Crystals of cholesterine. Oil globules and granular matter are seen in various parts of the field.

2. *The scale-like plates* were easily separated into very thin laminæ, which were found to be composed of perfectly clear, transparent vesicles, most of which had assumed a polyhedral form packed together, after the fashion of the vesicles, of adipose tissue. The refractive power of the vesicles was not great. The separated vesicles were ovate, and were larger at one extremity than the other. With very few exceptions they were perfectly clear, and their walls apparently structureless (fig. 3 *a*). A few of them were slightly granular, particularly at the larger end. Some of them were much altered in form, and approached in character the more superficial flattened cells of the epidermis.

* A year and a half after these scales had been placed in water, they were found to present the same characters as when recently obtained.

Case II.

Cholesteatomatous Tumor on the Buttock.

Another specimen of a cholesteatomatous tumor was sent me about a year ago, by my friend, Dr. May, of Reading. The patient was a lady about 55 years of age, very stout and plethoric. The tumor was about the size of an egg, situated in the fold of the buttock of the left side. It was in the subcutaneous fat, and did not involve the fascia. About half of it protruded. The tumor had existed 16 years, but latterly it had increased in size, becoming painful from congestion, and causing inconvenience when the patient sat down. Its removal was followed by erysipelas, which unfortunately proved fatal.

The microscopical characters of the tumor were precisely similar to those of the last case. Small plates of cholesterine were very abundant, and many of the peculiar transparent vesicles, similar to those described, were observed.

These tumors are exceedingly rare. They are more frequently met with about the base of the brain than in other situations; and it is curious that several of the cases in which they have occurred were lunatics.

J. Müller first described this form of tumor, and alludes to the pearly lustre of the scales, and their polygonal, transparent epidermis-like aspect. The tumor which he describes, perforated the dura-mater and occipital bone.

Dr. Gull describes one which was situated at the base of the brain of a lunatic in Colney Hatch Asylum, so as to compress the medulla and pons.

Another case is described by Dr. Thurnam, and reported upon by Dr. Bristowe, in the fifth volume of the "Transactions of the Pathological Society of London." This was situated on the upper surface of the medulla oblongata, and appeared to have been developed in the convolutions under the edge of the right lobe of the cerebellum. The patient was a woman aged 60, a lunatic in the Wilts County Lunatic Asylum.

Dr. Wedl gives a figure of a cholesteatoma connected with a cystic sarcoma of the breast.

Cruveilhier, Rokitansky, Virchow, Lepestre, and others, describe similar tumors in connexion with the brain or its membranes.

I have not met with reports of cases of these tumors occurring in the parts of the body in which those described in this communication were situated.

ANALYSIS OF SOFTENED CEREBRAL MATTER SURROUNDING AN APOPLECTIC CLOT IN THE LEFT HEMISPHERE OF A WOMAN, OF THE CLOT ITSELF, AND HEALTHY PORTION OF THE BRAIN.

THE patient, who was under the care of Dr. Todd, in King's College Hospital, was an unmarried, nervous woman, aged 40, a schoolmistress, of a dark complexion, with grey eyes and grey hair. She had always been temperate, had lived well, but of late had suffered much anxiety with reference to money matters. Her health had always been good.

Three months before her admission, she fell down suddenly in a fit, but soon recovered. Shortly afterwards she again fell down by the road-side, and lost her senses, but how long she remained unconscious she could not tell. She gradually recovered the use of her limbs after this second attack, but her power of speech and memory were slightly impaired. She was now affected with slight twitches and spasms of the muscles of the left arm. Her memory, especially for recent events, became impaired, and she had the greatest difficulty of expressing her ideas in words.

At the time of her admission she spoke very deliberately, and had to consider a long while before she could answer a simple question. Her answers were sometimes quite irrelevant, and generally in monosyllables. Her pulse was 88. There was no paralysis, and the sphincters acted naturally. She remained about a fortnight in this condition. On the morning of April the 11th, a sudden attack of diarrhœa came on. About 1 p.m., she was attacked with convulsive movement of the limbs. The convulsions lasted only a few minutes. Soon afterwards she sank into a state of coma. At 6 P.M., the legs were suddenly drawn up, and convulsive twitchings occurred in the muscles of the arms. There was no distortion of the countenance. At 10 P.M., the breathing was stertorous, and the coma profound. The muscles were relaxed, and there was no reflex action in the extremities. The right pupil was smaller than the left, but neither contracted under the influence of a strong light. Irritation of the conjunctiva, however, caused contraction of the orbicularis. Death took place after the coma had lasted twenty-eight hours.

Post-mortem, 36 hours after death.

Head.—Membranes healthy—veins of dura mater turgid with blood—no increased subarachnoid effusion—surface of convolutions much flattened—whole brain appearing too large for its case, as if forced out at the surface by the increase of some structure within.

In the central part of the left hemisphere, about three-quarters of an inch below the convex surface, was a hard mass about the size of a hen's egg, which had a fibrous appearance at its circumference resembling hardened fibrine, but was soft in the central part in consequence of the presence of recently effused blood. The tumor itself probably consisted originally of a clot which had become altered by subsequent changes. The central matter surrounding the tumor was soft and pulpy, and was broken down by the slightest touch, while the consistence of the white matter of the hemisphere generally, was even firmer than usual. The lateral ventricles contained about an ounce of fluid. The corpora striata and optic thalami appeared healthy.

Heart much dilated—considerable thickening of mitral valve, with slight deposit upon the aortic valves about the corpora Arantii.

Liver apparently healthy—vessels of *kidneys* distended with blood.

The white matter of the hemisphere, apparently in a healthy state, the softened cerebral matter immediately surrounding the altered clot, and the clot itself, were submitted to analysis.

1. White matter of the hemisphere.
2. Softened cerebral matter surrounding the clot.
3. The altered clot.

	1	2	3
Water	71·4	81·49	85·62
Solid matter	28·6	18·51	14·38
Extractive matter	1·16	·93	1·75
Fat soluble in boiling alcohol	8·52	5·49	·49
Fat soluble in ether only	2·77	1·65	
Soluble salts	*·69	†1·03	‡·96
Earthy salts	·37	·52	·17
Vessels, cells, albumen, &c.	15·09	8·89	11·01

For the purpose of comparing the results, the proportion of the different substances in 100 grains of solid matter has been calculated, and the results are shown in the following table:—

	1	2	3
Solid matter....	100·00	100·00	100·00
Extractive matter	4·05	5·02	12·16
Fat soluble in boiling alcohol	29·79	29·65	3·40
Fat soluble in ether only	9·68	8·91	
Alkaline salts, soluble in water	2·41	5·56	6·67
Earthy salts, insoluble in water	1·29	2·80	1·18
Vessels, cells, albumen, &c.	52·76	48·02	76·56

In the softened portion an increase of water is to be noticed,

* The ash was very alkaline, containing alkaline, phosphate, sulphate, and chloride. † Consisting of phosphate, sulphate, and chloride.

‡ Containing phosphate and chloride, and much sulphate.

while the relative proportion of fatty matter remains unchanged. Both the alkaline and earthy salts are increased, absolutely as well as relatively. The substances insoluble in water are diminished.

CASE OF RAPE IN WHICH SPERMATOZOA WERE DETECTED IN THE MUCUS REMOVED FROM THE VAGINA.

A LITTLE girl was brought into King's College Hospital in July 1857, upon whom it was said a rape had been committed about three hours before. My friend Mr. C. Heath, house-surgeon, removed with a pipette a little of the mucus from the vagina at a point beyond the hymen, and after placing it upon a glass slide, sent it to me for examination. It was not examined until 6 hours afterwards, and being uncovered was quite dry. Nothing definite could be made out by submitting the dry mass to examination. It was therefore moistened with a drop of distilled water, covered with a piece of thin glass, and examined with a quarter. Numerous cells of vaginal epithelium were seen, and amongst them as many as 6 spermatozoa were discovered in various parts of the fluid. All these were well defined and free from the epithelium, but many others less perfect, the tails being broken or removed, were found amongst the vaginal epithelium.

A careful drawing of these was made under the quarter of an inch object-glass (215 diameters) and lithographed.*

Spermatozoa may be dried on a glass-slide and although kept for some time, when moistened with distilled water may be identified with certainty. They may be preserved as permanent objects in some preservative solution, such as naphtha and creosote, weak spirit, or glycerine. The latter fluid refracts the light rather too highly to see them very distinctly. The specimen above described has been preserved in solution of naphtha and creosote,† and the character of the spermatozoa are well seen.

EXAMINATION OF RAGGED FIBRIN-LIKE MASSES FOUNDIN THE SPUTUM OF AN OBSCURE CASE OF SOLIDIFICATION OF THE RIGHT LUNG.

THE following notes of the case were furnished by my friend Mr. Edward Ray of Dulwich, who sent me the specimen for examination.

"J. R. W., aged 62, a gentleman who had been in the Bank of England upwards of 40 years, came under my care

* "The Use of the Microscope in Clinical Medicine," No. II. "Urinary Deposits."

† "How to Work with the Microscope," page 36.

after his return from Ramsgate (where he had been staying about 4 months) on the 6th of November, 1856. He was of full habit (but had latterly lost weight), had enjoyed perfect health to about July 1855, and there was no history of phthisis or malignant disease in his family. His illness commenced with cough and spitting of blood, but his malady gave him no uneasiness until October of the same year, when the symptoms became more persistent, and since this period they have steadily increased, and for some months past have prevented his attention to business.

He complains now only of cough and hurried breathing, which are most troublesome at night or when in recumbent position. He sits up, and prefers his easy chair and the erect position to reclining in bed. He looks anxious, but complains of no pain. Respiration 30. Pulse 124, without much power. Skin cool. Tongue but slightly coated. Urine freely secreted. Appetite good. Bowels acting daily and excretions normal. Expectoration copious, consisting of a viscid mucus (containing pus globules with large epithelial scales) *occasionally* tinged with, or containing here and there, a florid streak of blood.

On examining the chest, the right side was flatter than the left, but there was some fulness above the right clavicle more marked during inspiration.

Anteriorly the whole of right side was dull on percussion. The left side resonant excepting the cardiac region.

Posteriorly.—The right side was also dull on percussion, excepting over the inner and inferior portion of right lung. The left side was perfectly resonant.

Anteriorly.—On the right side only tubular breathing could be heard most marked under the clavicle, where bronchophony was present.

Posteriorly.—The respiratory sound was normal only over a *small portion* of the inner and inferior part of the right lung. Tubular breathing only could be heard elsewhere, with occasional moist sounds. On the left side respiratory sounds were puerile.

The heart's sounds were normal, but the heart's action was more frequent than natural.

About the 14th of Nov., 1856, he expectorated a portion of solid matter, looking like a fragment of fibrinous matter.*

The patient somewhat rapidly lost power, the respirations increased to 40 and 48 in a minute. Enlarged glands could be felt above the right clavicle. Breathing in the left lung became oppressed. The patient could not sleep. The respiratory movements were impeded. The legs became œdematous, and he died on the 12th of December, 1856.

* This was submitted to microscopical examination.

A *post-mortem* examination could not be obtained.

Dr. R. Bright saw this case early and up to July 1856 with Mr. Wheeler, and once with me in November; the case had always been an obscure one. On one occasion some quantity of pus had been expectorated, as if from abscess.

The morbid sounds were confined to the apex of the right lung up to July 1856. Mr. Wheeler had had some solid portions, which were expectorated, examined; they were thought to be malignant.

Dr. Roots and Mr. Barry saw the patient at Ramsgate. Dr. Roots considered it to be a case of chronic inflammation of the lung. Mr. Barry regarded it as a case of tubercular disease.

When I first saw the case I looked upon it as one of consolidation of the lung after pneumonia; but the peculiar and occasionally coloured sputum with the expectorated solid matter led me soon to suspect malignant disease.

After several careful examinations of the masses expectorated in this case, I still feel doubtful as to the nature of the morbid change to which the solidification was due. One mass examined was about an inch in length and half an inch thick. Upon making a thin section and tearing it up carefully with needles, the substance was seen to be composed of a dense network of tubes of considerable size (about the 1-500th of an inch in diameter), the spaces between were occupied by a number of very minute granular cells, for the most part spherical, or nearly so, with an indistinctly fibrous material. There were also a few larger cells containing oil-globules. The tubes were for the most part filled with granular matter and oil-globules. Few would have allowed blood corpuscles to pass through them. The general appearance of the structure is represented in fig. 1, plate IX, and in fig. 2, a vessel evidently pervious, and containing a few blood-corpuscles, is represented. Fig. 1 is magnified 130, and fig. 2, 215 diameters.

It seems to me that these tubes were altered pulmonary capillaries. No yellow elastic tissue could be found, but it is possible that this may have degenerated. Coagulable material had been gradually deposited within the vessel until its tube had become completely obliterated. Portions having undergone these changes probably became detached from the adjacent tissue, still containing pervious vessels, and were removed from time to time in the expectoration. The little granular cells presented the general characters of those found in many exudations.

It is difficult to form an opinion of the nature of the case from these data alone, in the absence of a *post-mortem* examination, but it seems not improbable that it may have been one of tubercular infiltration, which had undergone softening in some places.

EXAMINATION OF A LARGE TUMOR CONNECTED WITH THE THYROID OF A WOMAN, AGED 54.

THE portion of the tumor was sent to me by my friend Dr. Eade. The case occurred in the practice of Messrs. Gibson and Bateman, who kindly furnished the particulars given below.

The swelling had existed for five or six years, and the patient had consulted several surgeons of eminence in London and Edinburgh, but great difference of opinion existed as to its nature. In November 1856, it had much increased in size, and the patient sought the advice of a surgeon in her own town. An exploratory incision was made, but after careful examination it was not considered advisable to attempt the removal of the tumor, but to endeavour to diminish its size by keeping up a constant discharge. This plan succeeded well, and by the middle of January the tumor had decreased to half its original size. Sometime afterwards, however, obstinate vomiting came on and ultimately proved fatal. The patient had been a teatotaller for years, and although her powers had been much reduced, she could not be prevailed upon to take the necessary amount of nutriment and stimulants.

A post-mortem examination was made. The organs of the body generally seemed healthy, and no trace of cancer or any other morbid growth could be detected in any tissue.

A thin section of the portion of tumor sent for examination was made with the double-edged knife, and after having been torn a little with needles was examined with a quarter of an inch object-glass. It was found to consist principally of a coarse form of white fibrous tissue in which small spaces of an elongated form were found here and there. These spaces were occupied by a collection of small granular cells.

In pl. IX, fig. 3, the characters of this tumor are represented.

The growth, although intimately connected with the thyroid, was clearly not the altered gland itself, but a distinct structure originating probably in the fibrous tissue and not in the proper structure of the gland. In cases of enlargement of the thyroid body the structure very closely resembles that of the healthy organ; the closed cavities of the gland are often very large, and contain a firm and perfectly transparent material, or viscid serum,—characters totally distinct from those observed in the examination of this tumor, which probably should be regarded as a rare variety of fibrous tumor.

TUMOR CONNECTED WITH THE LEFT CORPUS STRIATUM IN A MAN, AGED 20.

FOR the following particulars of the case I am indebted to Mr. Rae, of Greenwich Hospital.

N. M. aged 20, while in the West Indies in 1855, was attacked with headache and dimness of vision affecting both eyes. He attributes these symptoms to cold. When admitted into Greenwich Hospital, on the 31st of August 1856, he could only distinguish light from darkness. The pain soon extended along the spinal column. There was a general diminution of voluntary motion. The urine was not expelled from the bladder, the sphincter ani became relaxed and the power of deglutition was much impaired. The patient died from an attack of pneumonia on December 31st.

Post-mortem.—A tumor about two inches in diameter and two-thirds of an inch in thickness, with a nodulated surface, was discovered upon the surface of the corpus striatum of the left side, with which it was intimately connected. It extended through the septum lucidum and partially covered the right corpus striatum. Connected with each lateral ventricle was a cyst filled with yellow serum. That on the left side completely filled up the anterior cornu.

The tumor resembled the corpus striatum in colour and general appearance, and might be said to be an outgrowth from it. Upon section numerous small and separate clots were seen in different parts.

The structure of this tumor is represented in plate IX, fig. 4. The tumor appeared to be composed almost entirely of caudate nerve vesicles. Besides these large cells were a number of small granular corpuscles, a few of which are seen in the upper part of the figure. The capillary vessels were numerous but no nerve fibres could be detected. In the intervals between the nodular markings upon the surface and extending for some distance into the interior there was a considerable quantity of areolar tissue consisting principally of very many fibres of the yellow element as represented in fig. 5. In the upper part of fig. 4 is seen a capillary vessel. It is interesting to notice that this tumor, which certainly would have been termed a malignant growth if it had been examined by the unaided eye only, consisted principally of cells very closely resembling those of the corpus striatum itself, with which structure it was immediately continuous.

CLINICAL OBSERVATIONS.

REMARKS UPON THE TREATMENT OF ACUTE INTERNAL INFLAMMATIONS.

(An Extract from a Clinical Lecture delivered in July, 1857).

By R. B. Todd, M.D., F.R.S.,
Physician to King's College Hospital.

(Continued from page 4.)

LOOK, indeed, at our patient, Cook, whose case has led me to this subject! See how depressed she is by the mere force of the inflammatory affection of both lungs! Her pulse small, weak, compressible, and at 120; her heart's action feeble and rapid,—her surface pale and ensangueous; and yet this girl was well upheld from the commencement, she took no remedy which has any depressing influence. What must have happened in her case had she been largely bled to twelve or sixteen ounces, and taken tartar emetic freely? My impression is, that she would not have had power to go through the healing process, or that her vital powers would have been so diminished that the healing process would have stopped. The hepatised lungs would have remained hepatised (as I have often seen where blood has been freely taken), and the pericardial effusion which did undoubtedly take place, would have been so much more considerable in quantity as to have materially interfered with the heart's action, and added another cause of depression of vital power to those already in existence.

You will perceive, then, that according to these views, there are strong *à priori* reasons in favour of the policy of upholding our patients, even in the earliest stages of acute disease, by such food as may be best suited to their digestive organs, such as

is most readily assimilated, and calls for the least effort, the smallest expenditure of vital force, for its primary digestion. Nutritive matter in a state of solution,—broths, soups, farinaceous matters,—answers this purpose best, and also alcohol, which is directly absorbed without any previous change, and tends to feed the calorifacient process, and to diminish the waste of tissues, which would necessarily follow in order to maintain it.

Many people start with horror at the notion of giving alcohol in acute inflammatory disease. What! give brandy in inflammation of the lungs! it is only adding fuel to the fire, and cannot fail to keep up or to increase the morbid process.

Those who reason in this way take a narrow, and I must say, an incorrect view, both of the morbid process and of the healing process; they are led away by the name *inflammation*, which is likened in their imagination to an internal conflagration, to be quenched by some summary means, or to be starved out. Nothing is to be given but what is, in popular phrase, cooling, and, as blood is the great pabulum of animal heat, it is especially to be diverted from the seat of inflammation, or to be abstracted in such ways as the peculiarities of the case will permit.

This reasoning is of the most purely fanciful kind. It rests upon a very imperfect view of the phenomena, both local and constitutional, which accompany the inflammatory process. In fact it takes into account only two of the phenomena of this process, namely—the heat and the afflux of blood, leaving out of consideration both the exciting cause and the proximate cause of this heat and afflux of blood.

No doubt there is some analogy between an inflammation and a fire, and I might rest an argument in favour of my views upon the further prosecution of this metaphor; but I prefer to bring before you the real nature of the inflammatory process, and of the actual physiological changes which it involves.

Inflammation is a deranged nutrition. Like the normal nutrition, it involves supply and waste, and as the latter is considerable, the former will be proportionably so. The tendency in inflammation is to the more or less rapid formation of abnormal products, such as lymph and pus; and the supplies for these formations must be drawn from the blood or from the tissues, in both cases with the effect of more or less exhaustion of vital force, in the latter with more or less extensive organic disintegration. The active chemical process which accompanies

all these changes, engenders the great heat of the inflamed part.

The more this process of inflammation draws upon the blood the greater will be the exhaustion of vital force, and the more the whole frame will suffer; the more it feeds on the tissues, the greater will be the difficulty of the reparative process. Is it not, then, important that adequate supplies should be conveyed to this process, abnormal though it be? And is it not likely that the most appropriate supplies may be conveyed to it through the blood, so that the waste of tissue may be stopped, and the tendency to abnormal formations be checked, at least from that direction?

And this, in truth, seems to me to be but the plain and simple fact;—you must feed inflammations as you would other active vital processes. You must, that is, feed them to prevent them from extending to, and preying on, healthy organic structures, and committing great destruction. Bear in mind, too, that you cannot stop an inflammation so long as the exciting cause of irritation is inherent in the inflamed part; you cannot cure an inflamed eye so long as the irritating particle of dust remains adherent to it. It is wise policy, then, to try and gain time, until by antidotal means, or by elimination, you can get rid of the local irritation, whatever that may be.

The physiological expression for what is commonly called *suppuration*, is a more or less rapid waste of tissue or organic matter, and a conversion of the particles so wasted into what we designate *pus*. This conversion will, within certain limits, take place in greater quantity, and the more actively, the lower the vital power of the patient. Take two cases of erysipelas, involving the same parts, and in all respects alike, and place them in adjoining beds, feed one from the beginning of the symptoms, and give him stimulants, give the other milk and beef-tea; both patients will get well, but the first will have few or no secondary abscesses, the second will have them in greater or less number according as he may naturally have less or more power of vital resistance.

But to proceed to more practical points, our patient, Jane Cook, exhibited an example of the acute inflammatory process, proceeding to a very high degree, and involving several important organs,—both lungs, the corresponding pleuræ, the pericardium, the endocardium. The tripod of life was assailed in this girl's case. It is, therefore, a highly valuable illustration of the extent to which you are likely to be called upon to proceed

with the kind of treatment I have described. And on the other hand, I may remark, that being a young and healthy girl, not strumous, but clearly rheumatic in her diathesis, she was as fair a subject as one is likely to meet with for the successful practice of the bleeding and lowering plan.

Yet what was our practice? Besides the drug treatment, which I have detailed at the commencement of this lecture, this girl was freely supplied with beef-tea, and she had half an ounce of brandy every hour. At first the quantity of stimulant was not so great, it did not, indeed, exceed half that amount, but very soon, when we saw the inflammation spreading, and the vital power evidently diminishing, the pulse showing a marked tendency to become rapid and weak, the patient suffering from profuse sweating, which within certain limits was salutary, we did not hesitate to increase the quantity of brandy largely;—you have witnessed with what result. The pneumonia subsided quickly, so that on the fifth or sixth day the signs of hepatization had disappeared, and vesicular breathing returned in each lung. The pericarditis did not disappear so quickly. On the 16th of July the patient was troubled with diarrhœa, notwithstanding which, on the 17th all the signs of copious effusion into the pericardium were manifest; both the pulse and the breathing were greatly increased in frequency, and the patient suffered from orthopnœa. She was freely blistered over the heart; the brandy was increased to *six drams* every hour, beef-tea was given frequently in small quantities. The opium was continued, and the ammonia, with chloric ether, was also freely given.

During the spread of the pericardial inflammation the pulse rose from 104 to 120, and reached its highest point at 124. The breathing was excessively quick, but as the girl was of a highly nervous temperament much of that rapidity was due to her extreme nervousness, which became much augmented when she was under examination. She panted rather than breathed: but it was satisfactory to find in our daily examination of the lungs, that no cause for quick breathing existed in them at this period. It was due primarily to the cardiac disturbance, but was greatly aggravated by the hysterical state, which so often complicates and gives a peculiar complexion to the symptoms of more serious disease in women.

It was very remarkable that notwithstanding extensive pericarditis and some endocarditis our patient never exhibited any marked delirium. This is uniformly the case in acute diseases, erysipelas, fever, pneumonia, rheumatic fever, in which

alcohol is given, as it has been done in this case. Delirium is kept off by it. This formidable complication of acute disease ceases to trouble either the patient or the physician, if the former be duly supported from the beginning. And if delirium comes on, notwithstanding that you have been giving stimulants, you will generally find it desirable to give them more freely.

This is a fact which I have so often verified that I am enabled to enunciate it dogmatically, that alcohol carefully administered, from an early period, in small and often repeated doses, is the best preventive of and antidote to delirium in acute disease.

Indeed many of you who watch my practice know how rarely that symptom gives any trouble. It is altogether the merest trifle, as compared with what I used to find it when I adopted the so-called anti-phlogistic treatment. And thus a great source of danger to life is avoided.

This fact, as regards the influence of alcohol in the *prevention* of delirium is one of the most important which the clinical observation of cases treated by stimulants brings out. It is quite inexplicable by those who refuse to study the action and the mode of digestion of alcohol, and who, adhering to old prejudices, rest content with a practice under which, to say the least, great mortality occurs, rather than be at the trouble of carefully investigating the powers of an important remedial agent.

Another interesting point in this case deserves your attention. While our patient was getting well of the double pneumonia, pericarditis having already come on, a severe diarrhœa supervened, which depressed her very much. Did this contribute to relieve the pericarditis, as one might expect according to the ordinary antiphlogistic notions? On the contrary, immediately upon the attack of diarrhœa there ensued signs of pericardial effusion; the dyspnœa became much aggravated, and extended dulness on percussion was found to exist in a very marked manner over the cardiac region; the sounds of the heart became distant and muffled. Under the continued use of stimulants, for a short time in still larger quantity (an ounce per hour), with opium given more frequently, and free blistering of the cardiac region, these symptoms quickly subsided.

In most cases treated as our patient Cook has been, we have found that the pulse diminishes in frequency steadily from day to day in a very remarkable way. This was not the case with Jane Cook. At first the pulse showed a disposition to fall, and it came down from 120 to 116, and remained at this point for

two days; but on the occurrence of the pericarditis it rose again, but never exceeded 124. Notwithstanding the pericardial effusion it remained at this point, and afterwards fell to 120. I believe that the fall of the pulse was opposed chiefly by the highly hysterical temperament of the patient, but partly by the cardiac inflammation. The wonder was, that with the extensive inflammation, and the extreme debility, the pulse did not rise more—even to 140, or higher; this, on the other hand, was obviated by the presence of alcohol, which, when fully digested and acting favourably, tends to prevent the pulse from increasing in frequency, if it does not reduce it.

Lastly, our patient had a rapid convalescence. Once the diarrhœa was stopped the pericardial effusion became quickly absorbed. The signs of effusion were at their highest point on the 17th of July, by the 20th they had disappeared, on the 25th the patient was fairly convalescent; just twenty-three days from her admission. From the 25th to the 2nd of August her recovery of strength and colour was rapid, and she might have left the hospital at this time; but as a matter of safety she was detained until the 15th of August, when she left quite well.

Rapidity of convalescence is not the least important feature of the cases treated by this upholding plan. Once the acute mischief is subdued, it is surprising with what rapidity the patient emerges from the invalid condition. Of this we have numerous examples in all forms of acute disease, and in none more than in pneumonia, erysipelas, and continued fever.

In conclusion, let me impress upon you, that in supporting your patients (whether in acute or in chronic disease) you should be especially careful to avoid throwing too much work on the digestive organs at any one time. Your supplies should be always administered in small quantities, more or less frequently repeated; never in a large amount at once. They should be well timed and the exact doses defined. When alcohol is being administered largely, animal food is best given in solution, as in broths or soups. The ability of the patient to take solid animal food may be regarded as the signal for diminishing the supplies of alcohol. Experience has taught me not to give two kinds of alcoholic fluid at the same time; do not give beer and wine, or wine and brandy; any one of them will agree better, because it will be more easily digested, when alone.

Patients often flush a good deal upon the first use of stimulants; this alarms the practitioner and deters him from prosecuting their further administration, or leads him to a vacillating practice generally most injurious to the patient. It

is a mere prejudice to suppose that any harm arises from this flushing of the face; generally it is an indication that the process of digestion, either of wine or spirit, or of other food,* is carried on with difficulty, and it will commonly cease by modifying the manner of its administration, such as giving less at a time, and more frequently. Sometimes, indeed, flushing will occur because an insufficieut quantity is given, and an increase of the dose will get rid of it, just as an inadequate dose of opium disturbs the nervous system, whilst a larger one calms it.

In a word, I cannot too strongly impress upon you that, to do good with stimulants, you must use them early, with care and watchfulness, in very definite quantities, and not in a vacillating or timid manner. They are agents of inestimable value for saving life under all forms of acute disease, and I can say with truth, from a large experience, that the harm which they do (*in disease*) is grossly and unfairly exaggerated, and always due to the slovenly administration of them. The opponents of their use argue from their outrageous abuse in health, against their careful and scientific use in disease, forgetting how essentially different must be the effect of sixteen or twenty ounces of wine swallowed down within an hour or two, along with other food, and the same quantity carefully distributed in half-ounce and ounce doses over a period of twenty-four hours. I say it after mature reflection and a long course of observation, that there is no point of therapeutics so deserving of the study of the earnest-minded physician or surgeon who is zealous to save life, as that of the action of these agents, both in health and disease.

* The popular notion that alcoholic stimulants are not food, but a mere "flash in the pan," ought not to be encouraged by medical men in the present day.

ON MEASURING THE CONFIGURATION OF THE CHEST IN DISEASE.

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STETHO-GONIOMETRY.

PLATE XI.

THE mensuration of the thorax affords much aid in the diagnosis of the diseases of that portion of the body, and materially assists us in deciding whether a morbid condition there located be increasing or in process of abatement. The information which mensuration procures is remarkable for that precision and certainty which mark the data of physical science. In this respect it greatly surpasses in value that large portion of medical evidence called symptoms, on which medical diagnosis and prognosis are greatly founded, for these being in a great measure simply the sensations of the patient, may vary from hour to hour, although the important fundamental pathological conditions of organs may remain the same; and because the language, which is their exponent, is less fixed and precise than the symbols of physical science, and is often, in degree at least, determined by the temperament or even the varying temper of the patient. This contrast, drawn in favour of mensuration, is not intended to depreciate the importance of symptomology, without which testimony, most valuable in itself, would be lost, and cues for the application of physical tests themselves could not be obtained.

The mensuration of the chest, by which is meant that measurement which is effected by physical appliances, was, until lately, accomplished almost exclusively by the application of the tape measure. To determine the circumference of the chest it is passed round the part, but as it is the comparison of one side with another that is chiefly desiderated, the tape is applied in almost all cases to compare the semi-circumference of the one side with the semi-circumference of the other, and this is done by placing the end of the tape on a spinous process and carrying the measure round to a point at the middle of the sternum. This done on one side and then on another, the difference in the two measures gives the difference of the two sides. By means of this mode of measurement, we obtain the dimensions of the entire halves of the thorax, but it fails to

determine any particular part where the increase or diminution of dimension in a half of the chest, may be present; thus, the semi-circumference so taken would not inform us, in a case of protuberance of the præcordial region from great hypertophy of the heart, that the excess in the measurement was due to fulness of the præcordial region, it would simply notify an excess in the general dimension of the side. It is true, that for the measurement of a part of the thorax, the tape is employed, thus the distance from the nearest part of the sternum to the nipple, and the distance from the sterno-clavicular articulation to the nipple, are ascertained by the tape; but we find that a material increase of size and deviation from the natural configuration may be present, which can with difficulty be represented by this measure. Thus a præcordial fulness perfectly obvious to the eye, frequently fails to pronounce itself in a decided manner by the tape thus topically applied.

The distance of one part of the thorax from another, including the cavity between them, has been ascertained by means of callipers, and this instrument has afforded some valuable information, not obtainable by the tape. This instrument gives that information respecting the magnitude of a part of the half thorax which is not obtained by the tape; thus, where a deficiency is found in the right side, from consolidation of the front of the middle lobe, this may give rise only to a flattening of the third or fourth ribs in front, the callipers will declare this, while the tape will not detect it. The callipers have been recently improved for the purposes of thoracic mensuration, by Dr. Edwards, who has added to it a delicate and useful graduated scale.

Perhaps it may be permitted to say a word or two respecting some other mechanical contrivances employed in the diagnosis of thoracic disease. The elevation of the ribs in inspiration is measured by the stethometer of Dr. Sibson; during the elevation of the chest the instrument is carried forward, and the degree of its movement is indicated by a scale which is connected with the part resting on the chest. This instrument requires to be fixed at one end, and this is generally effected by supporting the arm on the back of a chair. Dr. Quain is the inventor of another instrument for measuring the elevation or expansion of the chest. It is more portable, and better fitted for the examination of different parts of the chest, and is more delicate than Dr. Sibson's. It consists of a thread, which is placed across the part to be measured, one end of which is fastened on the chest with the finger, while the other is connected with a spring which moves a handle on a dial duly graduated. The slightest

expansion of that part of the chest under the thread moves the spring, and this movement again indicates itself upon the dial.

The sphygmoscope which the author invented to denote the pulsations of the heart, is capable, when slightly modified, of proving a good measurer of the movements of the chest. When so used it is placed upon a fixed stand, and is then called a pneumatoscope. It consists of a small projecting bag of water, which is placed upon the chest, and has connected with it a graduated scale. The elevation of the chest in inspiration, as well as the fall in expiration, are delicately measured by it; by no other means can the absolute and the relative duration of these acts be so delicately measured.

The ingenious and interesting instrument the spirometer, invented by Dr. Hutchinson, measures the quantity of air expired from the thorax; but while it serves to indicate the total capacity of the chest for air, or for the vital capacity, as it is incorrectly called, it is utterly null, as an index of the capacity of any particular part of the breathing apparatus.

The instruments above referred to measure magnitudes, movements, and capacity, but deviations from the natural configuration of the thorax present themselves, which do not come under the description of magnitudes, movements, or capacity, and which cannot be measured by any of the means above enumerated. The deviations not so included, are of very frequent occurrence, many of them are observed at any early period of disease of the contained organs, and may be made subservient as elements in diagnosis, whether other evidence be more or less complete.

The deviations here referred to relate to the angles and curves formed by the bones composing the chest; by the junction of one bone with another part, and of bones with cartilages. Angles may replace curves, and curves may so alter as to belong to greater or smaller circles or radii than natural. Such deviations from the natural configuration being not at all or very imperfectly gauged by the appliances already described, the goniometer or stetho-goniometer has been introduced for their measurement as an instrument of diagnosis, &c., in diseases of the chest.

The chief deviations for the measurement of which the stetho-goniometer is adapted, occur at the upper and front part of the thorax, at the junction of the costal cartilages with the sternum, and at the junction of the costal cartilages with the ribs. But departures from the healthy configuration are of very frequent occurrence at almost all parts of the thorax.

Deviations hold in respect of portions of the sternum in relation to each other, or in respect of the entire bone in reference to the spine, the ribs, or of the mesial or tranverse lines. The natural curve of the entire sternum may be an unnatural deviation. The costal cartilages may incline in an abnormal manner to the sternum, the natural curve of the costal cartilages may be replaced by some unusual form, either angular or curved. The ribs and costal cartilages may incline to each other in preternatural planes, and the dorsal spine may present abnormal curves. Deviations from the natural configuration of the dorsal spine may be regarded and measured either by themselves or in reference to the plane of the sternum, the mesial plane of the body or the horizontal line. All such deviations may be readily measured by the stetho-goniometer. When deviations are confined to one side of the body only, the instrument may be made to measure the difference between the two sides, the healthy and unhealthy, by applying it successively to the corresponding parts.

A few words on the natural configuration of the thorax. The male adult is spoken of, except when it is otherwise mentioned.

The thoracic bones form a long case of a conical configuration, flattened in front and behind, having its longest diameter from above downwards. The diameter from side to side exceeds that from front to back, being about double; the greatest lateral diameter is found on a level with the 8th rib, at the lateral region; this is more than double its diameter at the level of the 1st rib.

The dorsal spine is placed in the mesial line, and describes a gentle curve, the convexity of which is behind, and the concavity in front. In the erect position a plumb-line would very nearly fall upon the upper and the lower extremities of the curve. The two arms of the stetho-goniometer placed respectively upon two equal divisions of this curve, becoming tangents to the curve, show an angle at their junction, for the most part about 170° in men, and about 160° in females, the back in the latter being more curved than in men: hence proceeds so much of the beauty of the feminine form, with its rounded outline, so conspicuous in—" the bending statue which enchants the world."

The sternum placed in the mesial line, in front, describes a curve from above downwards, the convexity of which is turned

outwards. The tangents of this curve measured by the arms of the stetho-goniometer indicate in most persons an angle of 175°. The sternum separates more and more from the spine as it descends, and is directed forward. The inclination forward is described by saying that the sternum forms with a plumb line touching its lowest point, an angle of about 165°. The outer surface of the sternum from its superior part to the attachment of the 4th rib, is wholly plane, below the latter part it shows a slight concavity. The outer surface, from right to left, is strictly in health, in the transverse plane of the body; all deviations are unnatural.

The ribs of either side form a rude semi-circle. The circle described by the front part of the first seven ribs, is larger than that described by the posterior part. The circle described by the outer portion is much smaller than either of the others. The arms of the stetho-goniometer placed upon the front, and used as tangents, so to speak, indicate an angle of about 160°; and upon the lateral regions below the axilla an angle of 150°. The first rib is the only one which is nearly horizontal. All the ribs are inclined downwards, and this inclination increases from the 6th to the 12th rib.

The costal cartilages, which are very important in this investigation, occupying as they do a large portion of the front of the thorax open to physical examination of the nature here treated. They occupy the space between the ribs and the sternum, and increase in length from the 1st to the 7th. The 1st is the broadest, and descends a very little in its course from the rib to the sternum. This cartilage, in its descent, forms, with the transverse plane of the body, an angle of 177° or 178°. The second cartilage is horizontal, the third ascends a little, and with a horizontal or transverse line forms an angle of 183°. The 4th and 5th costal cartilages incline very considerably upwards. The upper cartilages present a slight convexity on their outer surface, the curves of which are of much the same degree. Measured by the stetho-goniometer, the curve may be said to be about 165°. The length of the first cartilage is about an inch, and each cartilage as we descend gains about half an inch. The upper portion of the front of the chest, including the sternum and the cartilages on both sides in front, describe a curve of pretty uniform configuration, which, measured by the stetho-goniometer is about 165°.

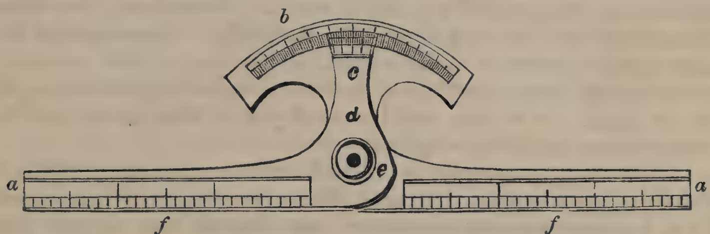
During inspiration, the sternum and costal cartilages are elevated. The latter parts have their curves increased, the lateral parts of the ribs are elevated, and the lower eight are forced somewhat outwards. The distance of the sternum at

its upper extremity from the opposite vertebræ, is about $2\frac{1}{2}$ inches, its lower extremity from the opposite vertebræ, is 6 inches. The distance from the 8th rib of one side, to the 8th rib of the other, is 10 inches.

In females the ribs describe curves of smaller radius than in men; and the younger the chest is, its curves are of comparatively smaller radius.

In health, few straight lines or angles are to be observed in the outline of the thorax, but the case is different in disease, for in phthisis and other maladies straight lines and angles are frequently found. These of course admit of ready measurement by means of the stetho-goniometer. But the deviation from health in many instances consists in an alteration of the natural curve rather than in the replacement of a curve by a straight line or an angular development. Though the goniometer cannot pretend to measure curves with the same accuracy as angles, it will practically prove as useful in the one case as

FIG. 4.



Stetho-goniometer, for measuring the inclination of different parts of the walls of the thorax in cases of disease, *a a*. The arms. *b*. The arc of a circle, graduated from 120° to 220°, the latter degree being on the left hand. *c*. The vernier, with an arrow at zero; the index of degrees. The vernier is divided into 12 equal parts, the whole being equivalent to 1° on the arc, or to 60′. *d*. Vernier arm. *e*. Joint. *f*. Inches and 10ths of inches, marked by lines which when brought into line by bringing the two arms nearly together, would determine the 1st degree, if instead of an arc it had an entire circle.

in the other, for the approximation to the truth will be so near as to be in practice equivalent to it. The absence of great mathematical nicety will not interfere with the useful revelations of the instrument. To measure curves has always been an acknowledged difficulty, but with the arms of the stetho-goniometer, employed to measure the angle of tangents to curves, on which they are placed, a highly useful approximative measure will be obtained.

The word stetho-goniometer is composed of three Greek words signifying chest, angle, and measure. It is of much the same construction as the goniometer employed in the examination of crystals. The stetho-goniometer, as already stated, is intended

to measure the angles at which the planes of different parts of the thorax are inclined to each other; and to determine tangentially the comparative configuration of curved surfaces. It is formed of two arms, each three inches long, jointed together, and connected with them are an arc, divided into degrees, and a vernier.

The edge of the arms are to be placed upon the chest. When both arms rest upon the same plane, the vernier points to 180°, the angle represented, if I may so speak, by a flat surface or a straight line, the condition in fact of the instrument in this state.

The degrees commence when the lines on the arms may be seen in line, and the circle is completed when the arms, having revolved, present their lines again in line. When the arms have completed less than half a revolution, the vernier points to angles under 180°; when they have completed more than half, the vernier points to angles greater than 180°. The angles of the chest to be measured by the stetho-goniometer, range almost exclusively from 120° to 220°; an arc, therefore, has been adopted which includes these degrees only. It comprises the plane and degrees on either side. This range will generally be found sufficient, but for a more extended inquiry a longer arc or the entire circle may be employed. The arrow on the vernier arm marks the degree.

When a great nicety is desired and minutes are required, which will seldom be the case the vernier may be employed. This, in the stetho-goniometer, subdivides the degree into twelve equal parts. These twelve parts correspond exactly with one division on the arc. Each division therefore on the vernier is smaller than the division on the arc by the 12th part of a degree. Thus, each division on the vernier represents 5′ (minutes), and as there are twelve, the vernier corresponds with 60′ (minutes) or 1° (degree). When a degree without any minutes is indicated, the star or zero of the vernier is in a line with a line of the arc. If the star point to a degree and a little more, and we desire to know how much this is in minutes, we look along the vernier for that line which coincides or is in a line with a line on the arc. If we are reading angles *up* the scale, ascending, we count from the right hand, and multiplying each line by five, we determine the number of minutes. If we are reading down the scale—say, measuring an angle of less than 160° —we look for the line on the vernier corresponding with a line on the arc, and, counting from the left hand, we multiply by five, and determine the number of minutes. The vernier will

seldom be required in stetho-goniometry, yet, an acquaintance with it is not undesirable.

The arms of the stetho-goniometer are divided into inches. When the instrument is employed to measure an angle formed by the vertical line and another line, one arm is placed in the perpendicular, and this is done entirely by the guidance of a plumb-line, or of some line or body corresponding with it. When the horizontal line is required for one arm of the instrument, it is guided by a body occupying that position, and placing the two in a horizontal position. When great nicety is required, a level may be employed to give the horizontal line. The measurement of angular parts is very easy; the point of junction of the two arms of the instrument is placed over the point of junction of the two planes to be measured, and the two arms are respectively applied to the two planes; the degree indicated by the arm is the angle of the inclination of the two planes. To measure the depression of the clavicle or of the ribs from the horizontal line, we place one arm in the plane of the horizon, and another in the plane of the clavicle or rib, and read off the degree indicated by the arrow. If we desire to know the extent of the projection of the sternum, we place one arm, say the lower, in the vertical line, and lay the other upon the sternum in its long direction or axis.

The angular measurements are thus made by the examination of two real planes of the body, or by the examination of one plane of the body with fixed standards, the vertical and the horizontal or transverse lines. In some cases, the measurement of the two planes of the body will suffice in the examination of the patient, as when a costal cartilage suddenly retires from the sternum, which still maintains its normal plane, but where the flattening or receding involves the sternum, which is frequently the case in phthisis with large old cavities, or in great condensation of the lung, this measurement is not sufficient, and it is necessary to take the angle formed by the transverse plane of the sternum with the transverse plane of the body. A great abnormal deviation may be now exhibited, not to be appreciated by the former measurement only. The point of junction of two parts of a bone, or of two bones, may not be strictly angular, being somewhat rounded or curved, yet when the curvature is not considerable, and the two parts as they separate, obviously describe an angle, the junction may be practically treated as an angular one.

Many deviations from the natural form of the chest, cannot possibly be regarded as angular, and are essentially curves or

portions of circles, it is desirable to measure them both for recording and for comparison with sound parts. This may be done with the stetho-goniometer in this manner: we fix upon

Fig. 5.

the apex or middle of the curve, and upon a point which divides the portion of a curve which is on either side of the apex, into two equal parts; we then bring the arms of the instrument to form tangents to the curves at these points, the joint part of the instrument being held above the apex. The degree on the arc pointed at by the vernier, will be an accurate indication of the configuration of the curve. To compare one curve with another—say, a natural with a preternatural one—the arcs to be measured must be of the same length. The larger the circle of which the curve is a segment, the greater is the angle of the tangents. It will be found that the stetho-goniometer so employed, will practically afford not only a good measure of the angle of the tangents to the curve at their bisection, but will give a fair rough outline of the curve itself.

Depressions, whether angular or curved, may be measured with the stetho-goniometer. When angular, the instrument at its point of junction is applied to the point of union of the two lines of the body, and the arms laid upon the retiring planes respectively. In the case of a curved hollow, less exactitude is procurable, but a fair rough measure is obtainable, which is valuable for comparison and record, and even a tolerably exact outline is placed at our command. The centre point of the instrument is placed near the lowest part of the hollow, and, as it were, opposite to the apex, and the arms are held, on either side parallel with two tangential lines. Hollows of smaller radius are represented on the stetho-goniometer by the complement of the angles shewn on the goniometer. The arms, in the first case, approach each other more, or more nearly complete the entire revolution of the circles; and, therefore, indicate a higher degree. Such depressions, both curved and angular, are frequently seen in diseases of the thoracic organs, and I may here state that lately I found the sternum to be the depressed angular point of meeting of the clavicles, in a case of phthisis marked by great

depression of the middle of the chest, and of projection of the shoulders. In this case, instead of having a curve of 170°, there *was an angle* of 195°.

The stetho-goniometer, constructed by Mr. Adie, of the Strand, is made of ivory, weighs less than half an ounce, and is therefore very portable. Its employment occupies very little time, and is in no way disagreeable to the patient. It is simply requisite to uncover the chest, but this is essentially necessary in any examination that would pretend to accuracy or completeness.

The following figures will illustrate the mode of application:

Plate XI, fig. 1, represents the chest of a girl 14 years old, afflicted with pulmonary consumption. The left lung is the seat of a cavity, and of much contraction of the remaining pulmonary structure, probably due to the presence of much fibrous exudation in the structure itself, and upon its pleural surface. The left side of chest has undergone great retraction, very obvious to the eye. The sternum has deviated from the transverse plane of the body, and forms with it an angle of 170°. The transverse plane of the sternum forms a straight line with the first three costal cartilages. The left clavicle has declined at an angle of 175° with the horizontal line, while the other clavicle rises and forms an angle of 185° with the horizontal line. The goniometer is placed on the left side, the joint resting upon the right border of the sternum; the right arm is placed upon the sternum and the 2nd costal cartilage, while the right arm is maintained in the transverse line of the body. The index points to 170°. The heart has been dragged upwards, and the auricle is felt pulsating at the 2nd left interspace synchronously with the apex in the 4th interspace. Great as is the retraction in this case, marked not only at the part on which the instrument is applied, but by remarkable flattening on the whole left front, delicately indicated by the goniometer, the total loss on the whole semi-circumference of the thorax, as measured by the tape measure, is only half an inch. This figure indicates a deviation from the natural relation of the transverse plane of the sternum to the transverse line of the body. This patient is now in the Hospital, under Dr. Cursham.

Fig. 2 represents a lateral curve of the spine in a case of phthisis, under the same circumstances. The arms of the goniometer are made to occupy the place of the tangents to the curve of the spine. The angle at which these tangents bisect each other is one of 168°. The convexity looks to the diseased side.

Fig. 3 represents the chest of a youth suffering from very

great hypertrophy of the heart, with deficiency of semi-lunar and mitral valves, causing loss of symmetry in front of the thorax. The left mammary and inframammary regions are very full; the curves of small circles are replaced by curves of much larger circles, by which a flattened, though, at the same time, a greatly fuller aspect is conferred. The stetho-goniometer is placed upon the left* region in a vertical direction, and it will be observed that the arms of the instrument tend to form one straight line. The arms of the instrument are made to occupy the place of tangents to the curve, and the angle made by the bisection is one of 164°. The angle of tangents to the curve on the corresponding part of the other side of the chest is one of 150°. The instrument is represented on either side of the chest.

It is believed that enough has now been said to indicate the objects of the stetho-goniometer, and to illustrate its application in the measurement of the angles and curves of the chest. A very little practice with the instrument will make it available in the hands of the student. It will probably be found to afford, as already said, data not to be obtained by other means. It will give a definite symbol of phenomena, which cannot be misunderstood, which admits of accurate record for purposes of future comparison, and accurate communication to others present or at a distance. The author believes it will assist in the diagnosis of disease in its early as well as in its later stages. By leading to a close examination of the chest, facts otherwise likely to escape notice will be discovered, and by fostering habits of diligent and precise observation, cannot fail to be of use to the student as well as ultimately to the sick who are to come under his care. While it is capable of supplying facts not obtainable by other mechanical contrivances, its revelations will often be found to derive confirmation and important qualification from them, so that, in bringing the stetho-goniometer before the profession, it is far from the author's intention to depreciate other means of determining the state and conformation of the thorax.

In the next part of this communication, it is proposed to give the history of some of the more important deviations from the natural configuration of the thorax measurable by the stetho-goniometer, which are found to arise from maladies of the contained viscera and investing membrane, and which the author has seen in a very large proportion of the patients, including many in the first stage of pulmonary consumption, who have come under his care at the Brompton Hospital.

* Drawings 1 and 3 have unfortunately been reversed, so that the left side in the drawing is really the right side of the patient.

ON THE NATURE OF VARIOUS SUBSTANCES FORMED IN OR DISCHARGED FROM THE UTERUS AND VAGINA.

By Arthur Farre, M.D. Cantab., F.R.S.,
Professor of Obstetric Medicine in King's College.

No. I.—*On Exfoliation of the Epithelial Coat of the Vagina, producing Casts of that Canal; with Remarks on the true Form of the Vagina.*

PLATE XII.

FROM no organ in the human body probably are substances of such various kinds expelled as from the uterus and vagina. These, besides the natural products of conception, include various abnormal substances, the result of aberrant or arrested gestation, as well as outgrowths from and degenerations of the proper tissues of these organs, occurring quite independently of pregnancy. It will suffice to mention the substances commonly termed polypi, moles, hydatids, and dysmenorrhœal membranes as examples.

Modern investigations, especially with the aid of the microscope, have acquainted us with the true nature of some of these; but others have been little if at all examined, and there are probably none which will not well repay carefully repeated observation.

Of the less examined substances, and of those which appear to have been not yet investigated, I propose to give an account, so far as these have fallen under my observation; selecting for the subject of the first of a series of papers, certain products of the vagina, which have probably hitherto been confounded with substances of uterine origin.

In cases of dysmenorrhœa, as is now well known, certain portions, or sometimes the whole of the natural lining of the uterus, may be shed in the form of a dysmenorrhœal membrane. The identity of these membranes with the mucous lining of the uterus, as well as with the decidua formed in early pregnancy, does not admit of dispute; and it is probable that a knowledge of this fact has led to the supposition, that all apparently membranous substances discharged under such circumstances, when not consisting of coagula or products of conception, are of this nature; but I have satisfied myself that some of these are not only materially different in structure from dysmenorrhœal membranes, but are not even of uterine origin.

This is the case with the three examples selected for the subject of the present communication.

The first occurred several years ago, in the case of a lady who came under my care for occasional attacks of dysmenorrhœa.

Learning that she sometimes passed membranes I procured one of these, and examined it carefully under fluid. The substance expelled (plate XII, fig. 4), consisted of a thin double layer of a somewhat slight yet tough and parchment-like membrane, of an opake white colour, and smooth almost lustrous or pearly surface. It appeared at first to be a cast of the flattened interspace between the uterine walls which constitutes the cavity of that organ, and exhibited very much of the triangular form of the uterus. The two membranous layers of which it was composed were in close apposition, and were bounded by a peculiarly sharp, thin border, like the marginal folding of the uncut pages of a book.

Yet, supposing this to have been ejected from the uterus, there were still many conditions irreconcilable with such an hypothesis. The size of the entire cast, which exhibited the triangular outline of the uterus, was more considerable than the cavity of that organ in the usual unimpregnated state. The angles that should correspond with the points of entrance of the Fallopian tubes shewed not the slightest trace of an aperture, and nowhere was there any of that cribriform appearance, produced by the pores of the uterine glands, which is so characteristically shewn upon the inner surface of true dysmenorrhœal membranes, while the outer surface was not rough, but smooth and lustrous. The whole was found, upon microscopic examination, to consist of broad flattened nucleated cells of pavement-epithelium, and was entirely destitute of the histological characters of the uterine mucous membrane.

The example, figs. 1 and 2, Plate XII, representing a preparation in the Anatomical Museum of King's College, gave me the first clue to the true nature of these substances. The preparation is entitled, "False Membrane from the Uterus." Like the former example, it consists of a sheath of dense opake epithelium, but the outer surface, instead of being smooth, is indented everywhere, so as to form numerous pits and depressions (fig. 1), running in oblique lines, and exactly representing the course of the vaginal rugæ. When the preparation is laid open, and viewed from within, (fig. 2), the furrows upon the reverse surface are seen to be converted into rugæ, having the ordinary arrangement of the columnæ rugarum upon the inner surface of the vagina. This specimen has more of the cylindriform figure than the former one, and at its upper end is a depression corresponding with the cervix uteri.

The chief differences between this and the former specimen are, that the cast is here evidently that of a narrower and more tubular canal, and exhibits the rugæ which are wanting in the former: differences which I have no doubt depend upon the

circumstance that the one is the cast of the vagina from an unmarried* and the other from a married person, in whom the surface of the vagina had become smooth by unfolding and obliteration of the rugæ.

A third example, (fig. 3), presented to me about eighteen months ago, by Mr. Henry Willington, of Brompton, has completely removed all doubts from my mind as to the true nature and source of these substances. As the history of this case is important I give it in Mr. Willington's words.

"The 'mole' was passed by a married lady, at a menstrual period. She has borne three children; the youngest 4½ years old. She was, when I first was called to attend her, the subject of severe pain, with sickness, at the menstrual periods, for which no relief had been afforded, and lately only, 'say four months before the passage of the mole,' she asked my aid. A few days previously to the menstrual period immediately before the one when the 'mole' was passed she consulted me for a fulness at the anus, and great uneasiness in sitting down; accompanied with a peculiar movement of crawling in the vagina, 'up in her inside,' to use her own words. The sensation was intolerable, only relieved by an injection of Goulard water. The relief was complete for some hours. Not much notice was taken of this, until the bearing down and peculiar sensation came on again at the next menstrual period, and was described as a 'peculiarly crawling sensation.' An hour after I left the patient, the proper menstrual discharge came on, and the mole was found in the linen, and was felt to pass the vagina. There was no hæmorrhage, nor increase of the flux, nor anything else that followed; nor in the three subsequent periods. The painful character of the menstruation is now much altered, and no drugs are now taken for it."

This specimen, represented in fig. 3, is in some respects more interesting than either of the two former. Its surface is smooth and shining like the first (fig. 4), and has the same dense, white, parchment appearance. It possesses the cylindriform character of the second specimen, and at the same time exhibits at its upper extremity, in a marked manner, that peculiar crescentic border, perfectly destitute of any aperture at the apparent seat of the Fallopian tube (if this were a cast of the uterus), which was so puzzling a feature in the first specimen, (fig. 4). There is here also, as in the other examples, an entire absence of the cribriform markings and soft fleshy texture

* Dr. Watson, by whom this preparation was presented to King's College, has since informed me that the young woman from whom this substance was passed, was then a patient under his care in Middlesex Hospital, suffering from dysmenorhœa.

characteristic of ordinary dysmenorrhœal membranes. Like the other specimens this cast consists of nothing but tessellated epithelium.

But the most important and interesting feature is observed in the upper part of this specimen (fig. 3). Here is seen a cup-like depression, having in its centre a transverse cleft, exactly corresponding in size and position with the two lips of the cervix, separated by the os uteri. So that in this case, as well as in that represented by figs. 1 and 2, not only the entire epithelial lining of the vagina, but that portion of epithelium also which covers the part of the cervix uteri that projects into the vagina, commonly termed the vaginal portion, has been exfoliated and expelled in one mass.

It is also interesting to observe that this process of desquamation has not in some of these cases been limited to a single act of exfoliation, but has been evidently repeated at intervals; for in two of the instances here given distinct traces of a second set of membranes were found enclosed within the first; and this fact illustrates, in a remarkable manner, the statement made in the history of the last case, namely, that the "peculiar crawling sensation" experienced in the first attack, which was relieved by vaginal injections, came on again at the next menstrual period, when the two casts were expelled, one contained within the other.

The specimens here described are instructive in another and different point of view, as displaying the real form of the vagina, when in its ordinary state of vacuity and collapse. Being actual casts of that canal they may help to correct the conventional notions of its form which the ordinary representations in obstetric and other works are apt to give. For the vagina is not in its normal state an intestiniform tube of four or five inches in length, which is probably the general notion of it, although, from its great elasticity and capability of both elongation and lateral distention, it may be made to take various forms, so that it adapts itself alike to the ordinary tubular speculum and to almost any form of pessary, whether globular, oval, or elipsoidal. In spirit preparations, also, as found in anatomical museums, an unnatural form is often given to the tube by distention of it before mounting: but if the vagina is examined *in situ*, just as Kohlrausch has represented it in his admirable sectional view of the female pelvis and its contents, of their natural size,* it will be found to be a short flattened canal, the

* Zur Anatomie und Physiologie der Beckenorgane, von Dr. O. Kohlrausch. Leipzig, 1854. This is the only view of the female pelvic viscera with which I am acquainted giving an accurate idea of the actual form and dimensions of the vagina.

anterior and posterior walls of which are in mutual contact; measured along the anterior wall from the median tubercle of the vaginal orifice to the margin of the anterior lip of the cervix uteri it commonly does not exceed *two*, or, at the utmost, *two and a half inches*, while the length of the posterior wall, from the hymen, or the entrance of the canal, to the extremity of the fornix, where the peculiar crescentic fold occurs, of which I have just given a description, does not ordinarily exceed *three* inches. The width ranges from one inch to an inch and a quarter, the broadest part being at the upper recess or fornix. The upper wall is shorter than the lower or posterior one, because the cervix uteri is let into it in a peculiar manner, close to its extremity, exactly in the position shewn in the epithelial cast, fig. 3.

I believe that a knowledge of the several conditions under which exfoliation of the vaginal epithelium occurs will be found to have an important practical bearing upon many of these abnormal conditions, not only of the vagina, but also of the cervix and os uteri, which so commonly fall under the notice of practitioners, and are accompanied often by so much local and constitutional irritation and disturbance.

The vagina deprived of its epithelium may be compared to the red and raw tongue of a person suffering from gastric and intestinal irritation. And it is probable that the extreme sensitiveness of the vaginal mucous membrane, which is so prominent and distressing a feature in erythematous conditions of this canal, is as much dependent upon an imperfect covering of the papillæ, occasioned by loss of their external epithelium, as it is upon a direct heightening of the sensibility of these structures.

But the amount of suffering which accompanies loss of the vaginal epithelium, or contrariwise the absence of pain and soreness, will depend in a great measure upon the slowness or rapidity with which the epithelium is renewed. If an entire new epithelium is formed before the old one is expelled, just as after certain eruptive fevers, scarlatina for example, a new cuticle is formed underneath that which is in process of exfoliation, then the accompanying symptoms will consist rather of itching and irritation, such as occurred in a marked manner in the third case here related; while in cases where the epithelium is shed in detached fragments, and is very slowly renewed, the local pain and smarting will usually be severe, and will continue until a new epithelium of sufficient density has been constructed, and it is principally to the favouring of this process that topical remedies should be in these cases directed.

ON THE INFLUENCE OF SOLIDIFICATION OF THE LUNG UPON THE VOCAL VIBRATION.

By George Johnson, M.D., F.R.C.P.
Physician to King's College Hospital, and Professor of Materia Medica and Therapeutics in King's College.

UNTIL within the last few months I have been in the habit of considering that, as a rule, the vocal vibration or fremitus over solid lung is greater than over the corresponding part of the healthy lung, and that the exceptions to this rule are rare; further, that in this sign we have a valuable means of distinguishing between solid lung and liquid in the pleura, the vocal vibration in the latter condition being invariably diminished.

I believe still, that in most cases, there is increased vocal vibration over solid lung, but I think that the exceptions to this rule are more numerous than is commonly supposed; and I have been led to this opinion by finding that out of twelve cases of pneumonia which have occurred in my hospital practice during the last eighteen months, in three there has been decided *diminution* of the vocal vibration over the hepatised lung; while in two others the vibration was neither increased nor diminished, as compared with the corresponding part of the opposite side. The following is a brief outline of the most remarkable of these cases:—

Edward C——, æt. 17, was admitted on the 12th December, having been four days ill. He had all the general symptoms of pneumonia. On the day of admission, the physical signs were these:—dulness or percussion over the whole lower lobe of the left lung, from the spine of the scapula downwards; over the same space distinct bronchial respiration and voice, vocal vibration *less* than on the sound side. Over the front of the left side, *i.e.* the upper lobe of the left lung, percussion natural, respiration vesicular, clear and loud, vocal vibration *much stronger* than over the corresponding part of the right side.

On the 17th, the physical signs over the lower lobe were the same as before, but the upper lobe had become solid, as shown by the following signs:—great dulness on percussion over the whole left front; bronchial respiration and voice, and now *diminished* vocal vibration. The heart continued to beat in its natural position. The movements of the left side of the chest were much less than those of the right. The physical

signs remained unchanged until the time of the patient's death, which occurred on the 24th December.

On post mortem examination, the whole left lung was found solid, and of a mottled grayish colour. The pleura was covered by recent lymph, which formed a very thin layer except in some of the intercostal spaces, where it was about $\frac{1}{8}$ of an inch thick; there was no liquid in the cavity of the pleura.

What was the cause of the diminished vocal vibration over this solid lung? I have no explanation to offer; but I would remark, that it can scarcely be supposed that obstruction of the bronchial tubes was the cause of the phenomenon, in as much as bronchial respiration was heard over the whole left side, with a distinctness rarely observed when the entire lung is solidified by inflammation.

I wish to direct attention particularly to one phenomenon in this case,—namely, that during the first few days, while the lower lobe alone was solid and the vocal vibration over it was diminished, there was a great increase of vocal vibration over the *upper* lobe of the same side, which as yet was free from disease; but when this upper lobe became solid, the vocal vibration over its surface was as much diminished as it had before been and continued to be over the lower lobe. In two others of the twelve cases of pneumonia to which I have referred, it was also observed that hepatisation of the lower lobe of one lung had the effect of greatly increasing the vocal vibration over the upper lobe of the same side, the sounds of percussion and respiration over the upper lobe remaining quite normal. In one of these cases the vibration over the solidified lower lobe was much diminished; in the other it was neither increased nor diminished. In both cases the disease was on the right side, but the increase of vocal vibration over the right upper lobe appeared to be greater than the natural excess of vibration on that side.

I have lately observed similar phenomena in a case of acute tubercular disease of the lung, which is further remarkable on account of the tubercular deposit being more abundant in the lower than in the upper lobe of the lung. The following is a summary of the case:—

Charles Wood, æt. 42, a carpenter, had been ill six weeks before his admission, suffering from cough with scanty expectoration, fever, loss of flesh and strength; he had continued his work until three weeks ago. Admitted November 12th. He was much emaciated, and had a sallow, unhealthy appearance, skin hot, tongue red and dry, P. 116, R. 32. Decided dulness on percussion over the lower lobe of the left lung, slight dulness

over the left upper lobe, as compared with the opposite side. Bronchial breathing and voice near the angle of the scapula on the left side; *diminished* vocal vibration over the same space; over the left upper lobe in front, large crepitation, with *increased* vocal vibration.

On the 17th, the respiration at the angle of the scapula was doubtfully cavernous, and gurgling was heard in the same situation. He had expectorated only a few pellets of gray mucus.

The physical signs remained the same until his death, which occurred on the 23rd.

The lower lobe of the left lung was solidified by a tubercular deposit, which at the base had completely infiltrated the pulmonary tissue. At the upper margin of this lobe was a cavity the size of a walnut; some smaller cavities near this; a considerable tubercular deposit in the upper and back part of the left upper lobe; this was breaking down into small cavities, the largest the size of a marble. The lower and anterior part of this lobe was gorged, but crepitant. There was a scanty deposit of crude tubercle in the apex of the right lung.

With respect to the increased vocal vibration over the upper lobe of the left lung, it may perhaps be objected that this was the result of the tubercular disease and engorgement of this lobe; still the fact remains, that over the lower lobe which was much more solid than the upper, the vibration was decidedly less than over the corresponding part of the opposite side.

Another case in which we have lately found complete absence of vocal vibration over solid lung was one of primary cancer of the lung.

John Robinson, æt. 41, a painter, admitted June 7, 1856. Five weeks before admission, after exposure to cold and bad living, he began to suffer from pain in the limbs and in the right side of the chest. The pain in the chest continued, and he rapidly lost flesh.

On admission he had a pale unhealthy aspect; his chief complaint was of pain on the right side of the chest, and there was a hard swelling about the size of a walnut over the 8th and 9th ribs, just in front of their angles; this swelling was extremely tender. Dulness on percussion over the whole lower lobe of the right lung; at the upper part of this lobe the dulness was less complete than over the lower two-thirds. Elsewhere there was the normal resonance. Over the lower two-thirds of the inferior right lobe there was complete absence of respiratory and voice sounds, and of vocal vibration. At the upper part of this lobe, that is just below the spine of the scapula, there was

indistinct respiration, with some crepitation, and the voice had a bronchophonic character.

The patient continued to lose flesh and strength; he coughed and expectorated puriform mucus, tinged with florid blood, which often gave it the colour of red currant jelly; the skin was always cool; the pulse usually 104, and the respiration 24.

The physical signs over the lower lobe of the right lung remained essentially the same; but the dulness towards the upper part of the lobe rather increased, and the right side became decidedly flattened. The hard tumour before mentioned grew to be as large as an egg.

On the 24th July, the patient being then much emaciated, it was first noted that when he was in the recumbent position there was a distinct wave-like pulsation in the right jugular vein, and in one of the thyroid veins on the right side. This venous pulse ceased when he sat up.

On the 29th July, it was further observed that there was dulness or percussion and tubular breathing below the sternal end of the right clavicle.

The expectoration had become more copious, and had a dirty, purulent character. It was frequently examined with the microscope, and was found to contain pus, granular fat-cells and epithelium, but no fibrous lung-tissue, nor any products which appeared to be of a cancerous nature. Yet the history of the case, the physical signs, and the hard tumour on the right side, left little room for doubt as to the disease being cancer; and that opinion was expressed in a clinical lecture while the patient was living.

He gradually sank, and died on the 4th August.

The whole lower lobe of the right lung, except at its upper margin, was entirely occupied by a cancerous growth which was universally adherent to the wall of the chest, projecting between the 7th, 8th, 9th, and 10th right ribs, to form the tumour before mentioned, and forming another projection as large as an orange, which had made a depression in the upper surface of the liver. The centre of the cancerous mass was softened, and contained about twenty ounces of creamy fluid; this had no means of escape until the tumour was broken through in tearing it from its adhesions to the walls of the chest.

A mass of enlarged lymphatic glands formed a tumour which lay behind the right sterno-clavicular joint, touched the trachea and passed down between the right brachio-cephalic vein and the ascending aorta; its position between these two vessels being such, that it must evidently have communicated a

pulsation from the artery to the vein. This state of parts had been anticipated from the phenomena observed on the 24th and 29th August.

The only remaining point to be noticed is that in the apex of each lung there were some indurated remains of an old tubercular deposit. In this case the complete absence of respiratory and vocal sounds, as well as of vocal vibration, is accounted for by the entire obliteration of the pulmonary tissue through nearly the whole lower lobe of the right lung.

The cases to which I have referred, will suffice to show that the vocal vibration over solid lung is by no means uncommonly diminished, and it is evident that the diagnosis between solid lung and liquid in the pleura is often but little aided by a comparison of the vocal vibration on the two sides of the chest.

It has occurred to me on more than one occasion to find that pneumonia of the lower lobe of the lung has been mistaken for pleurisy with liquid effusion, a mistake which is the more likely to occur when there is diminished vocal fremitus over the solidified lung. There is one help towards a correct diagnosis in cases of this kind, which has, I think, been too little regarded by those who have written on the subject. In percussing the chest, we should bear in mind the form and limits of the lobes of the lung, and ascertain whether the extent of dulness corresponds with the outline of one or other of these lobes. If this be found to be the case, the probability is, that the dulness depends on solidified lung, and not on liquid in the pleura. Take, for instance, a case in which the lower lobe of the left lung is hepatised. It will be found that while percussion over the back of the chest elicits a dull sound from the spine of the scapula downwards, in front there is the natural resonance, and the lateral region is partly dull and partly resonant; the boundary line between the dull and the resonant part extending obliquely downwards and forwards from just below the spine of the scapula, in the direction of the fissure between the two lobes of the lung. It can rarely, if ever, happen that liquid in the pleura is so circumscribed as that while it extends as high as the spine of the scapula at the back, it will leave the front of the chest normally resonant when the patient is in the erect posture. When the upper lobe alone of the left lung is solidified, the line of demarcation is the same as in the other case, but the dull and the resonant parts are reversed. The middle lobe of the right lung, extending in front from the mamma downwards, may be inflamed and solidified alone, as happened in one of the 12 cases before mentioned, or it may be affected at the same time with either the upper or the lower lobe.

My object in the present communication has been to direct attention to three practical points relating to the diagnosis of pulmonary disease. 1st. That the vocal vibration is not unfrequently diminished over solid lung. 2nd. That when the *lower* lobe of the lung is solidified, the vocal vibration over the *upper* lobe of the same side, is sometimes remarkably increased. 3rd. That in percussing the chest, when the question of diagnosis is between solid long and liquid in the pleura, it is important to remember the exact form and position of the several lobes of the lung.

CASES OF CALCAREOUS DEPOSIT IN THE SUBSTANCE OF THE BRAIN.

By John W. Ogle, M.D., F.R.C.P.
Assistant-Physician to St George's Hospital.

Case I.

Epilepsy.—*Partial Paralysis.—Peculiar Stuttering and other Affection of Speech.—Mental Delusion.—Scrofulous Deposit in the Lungs and Scrofulous Caries of Ribs.—Deposit in the Brain (probably scrofulous) in which Calcareous Matter existed.*

F. JUPP, æt. 30, was brought into St. George's Hospital, September 19, 1854. He was a Coachman and unmarried, and had always been the subject of general weak health.

Previous History.—It was stated that about Easter he had been seized with a curious sensation in the throat, with a feeling of coldness and numbness in the right hand, as also great difficulty in speaking, and at times perfect loss of speech; these attacks were wont to come on twice or thrice a day, but not for 2 or 3 days together, and for the most part were accompanied by very severe pain in the head. On one occasion (as stated by the patient in writing, which was good and clear) he had been affected by loss of all strength for about a minute, with a sense of "*ringing through the head,*" and "*flashes of fire,*" in the eyes; he was also subject at the first to twitchigns of the

hands, and from time to time his sight would go for a few moments and he would be obliged to sit down.

Symptoms on Admission.—There was considerable thinness of the body, but it could hardly be called emaciation; there was slight strabismus, the cornea of the left eyeball being everted, and the pupils were rather larger than natural. The margins of both pupils, moreover, were somewhat uneven, and the iris of the right eye was discoloured and roughened by fibrous deposit, which appeared to have been the result of inflammation, which he said he had suffered from nine years previously. When he attempted to speak he always stuttered extremely, which he had not been in the habit of doing previous to his illness, and at times his speech altogether failed. As before stated, his sight would also fail completely at various times. Although his muscular system generally was weakened, yet no particular paralysis of the muscles of the limbs or face showed itself.

Course of Disease.—The above described condition existed for 5 or 6 months, with but little variation; after this period he gradually got worse and lay in a perfectly unconscious state for 10 weeks on his bed, passing his evacuations involuntarily, and only at times replying "yes" or "no," without any meaning. About the middle of March, 1855, he had an epileptic seizure, which lasted a quarter of an hour. In the attack he struggled very much indeed, the mouth and face being much affected, but the limbs on the right side of the body only, were affected by convulsive action. It was noticed during the attack, that the right side of the throat was greatly swelled, but not the opposite side. After the seizure he slept a good deal. During this month my notes were to the following effect: "Aspect good, but the patient is rather emaciated; both pupils are dilated and sluggish in action, the left eyeball is slightly everted, and both eyeballs, but especially the left one, are very prominent; on trying to speak he stammers greatly, and can only rarely make himself understood, as in attempting to speak he frequently repeats particular parts of words, and often omits the final syllables. He, however, seems to understand things and people, excepting occasionally; for instance, he can not be made to close his eyes firmly, but instead, will open his mouth; he seems at times as if he was deaf, and is extremely irritable, and fancies every body else is speaking and telling lies about him. Although he can only read a very little, yet he will constantly be having a prayer book, and pretends or thinks he is reading it. There is no facial paralysis, and the tongue, which is clean, is protruded in a straight line; there is no difficulty in swallowing, the

bowels are regular; the pulse is regular; there has never been any vomiting or even nausea. Both motion and sensation in all the limbs are complete."

On the 1st of April he had a convulsive seizure of exactly the same nature, and lasting about the same time, as the previous one in March; the limbs of the right side only, as before, being affected. About the middle of April he was much better and more rational in his speech—more understandable, but still he mispronounced words grievously, as, for instance, saying "carsel" instead of "candle," and "strain" instead of "straight." He explained his own symptoms tolerably well. The pupils of both eyes were dilated, but especially that of the left one, which was quite immoveable on the application of light, that of the right one being sluggish as before. Moreover the left eye which was, as before, everted, was devoid of the power of vision, and the sight of the left eye was very dim but varying. On being questioned as to his sensations, &c., he stated that in walking in his ward he fancied he saw holes in the floor, part of which looked lower than the other. In reading also, some letters had the appearance of having dropped. He stated that after having closed the right eye, which had no vision, he could for a short time see light with the left one, but it quickly passed away, and then he could see nothing. He had no delusion as to colours, and said he had lost the "blue things like wool" which used to appear as if they covered half the eye.

The tongue was furred, and the evacuations were all natural, and passed regularly. Appetite and pulse good.

May 9th.—"He was walking about in the hospital garden, and seemed much better."

June 7th.—"Stated that his 'eye-sight was the same.' He complained of pain in the head on moving about quickly, and of a feeling as if things were loose in all parts of the head. He moved all his limbs with equal facility, but complained of the right arm and leg feeling cold, and of having a curious feeling in them, but not of being numb. The temperature of the skin was however not really diminished. He still mispronounced words, saying 'messin' instead of 'medicine,' and 'called' in the place of 'caused.' His nights were very restless, and his urine, which was turbid with lithates, was passed very frequently. It contained no albumen."

September 9th.—"Yesterday he had a convulsive attack, in which he turned quite black, all his limbs becoming rigid, and the head drawn far and forcibly to the right side. At the commencement of the attack he made such a noise that he was thought by others in the ward to have been sick. Physical examination of the chest did not reveal anything morbid."

September 19th.—"He has had no more attacks, but on the 12th he had so much choking in the throat at times in talking, that he thought he was about to have one. Along with this unnatural sensation he experiences twitches, especially of the right side of the body, and at these times also the sight of the right eye 'gets a little dark,' and the heart palpitates greatly. As to his power of vision, he states that he sees a small amount of light very rarely with the left eye. He is very excitable and nervous, starting at the least surprise. There is a slight swelling at the back of the right arm, to which he draws attention, and he complains of having pain in the right arm and leg."

October 17th.—Complains of having had much pain of late at the back of the head and neck, and latterly at the left side of the head in particular. He says his eyes "get darker." The right arm and leg are less painful, but the swelling at the back of the right arm is the same. His hands feel cold to himself, but especially the right one. Speech and vision the same.

October 30th.—Has no rest at night, but has less pain in the limbs. Complains of a feeling as if he was going to drop or fall down a hill, and is much frightened when this occurs. He has never had any vomiting.

January 1st, 1856.—Has got much weaker, and the swelling at the back of the arm, which proved to be an abscess, has burst, and is now discharging freely. Has a large amount of acne on the skin of the forehead, with dark blotches, and a slight swelling of the integuments has appeared, corresponding to the upper and right part of the sternum.

February 27th.—The swelling before spoken of is now of the size of a pigeon's egg, and very soft and fluctuating. He also has lately complained much of pain over the right side, accompanied by cough, and dulness is found in the front of the chest.

He had been going on much the same until May 2nd, when he was seized in the course of 5 hours, with no less than 10 or 12 convulsive attacks, of apparently a similar nature to those before described. The earliest of these were much stronger and more violent than the later ones; during them he lost consciousness and bit his tongue, and became quite "*purple and blue, with a working of the left arm and drawing up of the right side of the face.*" There seemed to have been no warning of the attacks. There was no vomiting.

On May 12th he had two more very strong attacks, and complained much of pain at the left side of the chest; and on the 13th, he thought that another attack was coming on, but it proved not to be so.

On the 14th it was noticed that on speaking, the mouth was drawn to the right side, and that the tongue on protrusion was put out with a sweep to the left. The skin was hot, and the pulse quickened.

On the 27th he was very heavy for sleep, and more irritable in temper than usual. He was thought by the nurse to be about to have a seizure.

On the 23rd of June he had a violent convulsive attack, in which he died.

The TREATMENT resorted to, consisted at first of counter-irritants, including the use of a seton, with small doses of bichloride of mercury and tonics; subsequently of tonics, stimulants, and necessary aperients,—but for some time nothing but stimulants and food were administered.

On "*post mortem examination,*" the body was very emaciated, and a sloughy ulcer existed at the inner and back part of the right arm. The swelling corresponding to the upper part of the sternum proved to be an abscess beneath the pectoral muscles, connected with the sternal extremities of the 3rd and 4th ribs on the right side, along with their respective cartilages, which were very carious.

Thoracic Organs.—The pleural sacs on both sides were almost obliterated by firm adhesions, and both lungs contained large quantities of scrofulous matter. The heart was natural as to its valves, &c., but its walls were weakened.

Abdominal Organs.—Nothing worthy of note was observed in connection with these viscera.

Cranium.—The integuments of the cranium presented nothing unusual. The calvarium was very remarkably thinned, being in many places not thicker than a piece of card board, and also softened, yielding very readily to the saw. On its inner surface several bony pointed projections existed, especially along the various sutures of the bones, but also at other parts, and chiefly on the right side at the summits of the natural bony ridges between the depressions corresponding to the cerebral convolutions. The dura mater as a whole was natural, excepting at one part on the left side, corresponding to the upper and outer portion of the left cerebral hemisphere, at about its middle. Here the dura mater was very firmly adherent to the surface of the brain, to about the extent of a shilling, and to a slight degree around this adherent portion its inner surface was coated by a thin film of recently-formed fibrine. The arachnoid membrane generally was thickened, and in places very opaque. Much sub-arachnoidean fluid existed. This adhesion between the dura mater and the brain was effected by means of a callous fibrous deposit in which a mass of firm yellow matter existed, of about the size

of half a pea, along with a quantity of calcareous friable matter. The whole of this indurated material was so intimately united with the nervous substance as to have the appearance of a cicatrix penetrating it to about the distance of an inch; and on attempting to remove it, much of the brain came away along with it. The brain texture adjoining was somewhat softened, and a tolerably large amount of clearish fluid existed in the lateral ventricles.

On Microscopical Examination, the Brain showed much fatty matter, and capillaries and brain cells also occupied by fatty globules. Moreover, the proper nervous elements were very deficient, and seemed to have given way to a growth of most delicate fibrous material, probably an increase in the normally existing brain matrix. Otherwise, nothing worthy of special attention was observed in the nervous centres.

The calcareous matter, in connection with the firm solid material forming the bond of union between the dura mater and the brain, and before described, was found to consist of small masses of carbonate and phosphate of lime. The main solid cicatrix-like mass itself was found to be composed of firm fibrous tissue, containing a few spindle-shaped cells, in which a quantity of amorphous and fatty matter was embedded, containing corpuscular elements of small size, and irregularly rounded form. A few cholestearine crystals were observed, but no amyloid bodies.

Remarks on this case, and also on a second one, in which calcareous matter was found in the brain, will appear in a future number.

EFFECTS
OF
ARSENITE OF COPPER ON PAPER-STAINERS.

By Dr. Guy,
Professor of Forensic Medicine in King's College, and Physician to King's College Hospital.

IN the correspondence which has lately taken place in the medical journals and in the newspapers, on the effect produced upon the health of persons living in rooms covered with arsenite of copper paper, nothing has as yet been said on the more important question of the effect produced upon the health of the men engaged in the manufacture of the paper itself.

The colouring matter is mixed with size, and kept in a proper state for use by the heat of warm water. It is laid on to the paper with brushes, and suspended in the warm room to dry. When a bright green colour is to be produced, the arsenite of copper is used alone; but the lighter tints of green, down to the very palest, are obtained by mixing the arsenite with oxide of zinc or porcelain clay, or (for paper-hangings) with whitening. The colouring matter in the act of being laid upon the paper, stains the hands of the workman, and collects under the nails, and being absorbed into the system, produces the effects now to be described. After working one day with the emerald green, a papular rash makes its appearance at the junction of the nostrils and upper lip, then successively on the chin and back of the head, and, after working two days, on the eyelids. The rash also appears at the bends of the elbows.

These appearances are followed by irritation of the scrotum, which terminates in the formation of superficial round ulcers, looking as if they were cut out by a punch; they are about the size of a split pea. The rash, which is originally of a papular form, goes on in parts to pustulation. The rash on the skin lasts about five days; the ulcers of the scrotum are more obstinate. The rash is very painful, especially in the evening. Lithographic printers use the emerald green, and the boys who spread the powder, suffer more than even the paper-stainers, especially from itching of the scrotum. In some instances the scrotum is first effected; and in some other cases it is the only part that suffers.

I have had, as patients, four men, employed in the manufacture of green paper for book-covers and similar purposes (not for paper-hangings), and I have taken this account from their statements; as well as from personal inspection and inquiry at the manufactory where they are employed. The symptoms present in these patients, in addition to those which have been just stated, were inflammation of the conjunctivæ, not accompanied by any tenderness in the epigastrium. Of two patients, in whom the number of the pulse was counted in the erect posture, one had a pulse of 120, the other a pulse of 80. One of the patients, at the time when he applied at the hospital, had three or four open sores on the scrotum, one as large as a fourpenny-piece and one as large as a six-pence; he had also the rash behind the ears, and at the bend of the elbow, and he attributed the loss of a toe-nail and the expected loss of the nail of the right thumb to the same cause. Another workman stated that he was in the habit of working with arsenite of copper for one or two days at a time; that it made his eyes smart and his

nose and chin sore. The men stated that they were not able to continue at work for more than about three days at a time, that they use no precautions, but were in the habit of taking a dose of castor oil occasionally.

ON THE PRODUCTION OF PULMONARY CONSUMPTION IN PERSONS WHO WORK IN A CLOSE AND CONFINED ATMOSPHERE.

By Dr. Guy.

THE Report on the Sanitary Condition of the Army recently published proves that our soldiers, but especially the Infantry of the Line and the Foot Guards, are subject to a very high mortality, a great part of which is attributed to pulmonary consumption. It is assumed in the Report that this excess of mortality from consumption is traceable, at least in part, to the narrow space allotted to the soldier in the barrack and guard-rooms: but as no proof of the dependence of pulmonary consumption on this cause is given in the Report, it may be useful to re-publish, from my evidence laid before the Health of Towns Commission in 1844, the following table based upon measurements of the offices of letter-press printers, and the number of compositors working in them, together with the answers to certain simple questions addressed to the men themselves.

	Number per cent. subject to Spitting of Blood.	Catarrh.
104 men having less than 500 cubic feet of air to breathe	12·50	12·50
115 men having from 500 to 600 cubic feet of air to breathe	4·35	3·48
101 men having more than 600 cubic feet of air to breathe	3·96	1·98

It is scarcely necessary to add that the number of compositors who answered my question, Had they ever spit blood? in the affirmative, would correspond very closely to the number actually suffering under consumption; just as the number stating that they were subject to colds would afford a good indication of the number in the three classes who were predisposed by the same close and confined atmosphere to suffer by exposure to the common causes of diseases of the chest.

I am the more anxious to re-publish this table, as I believe it to be less known than its bearing on the solution of an important sanitary question would seem to require.

ON THE TREATMENT OF VARICOSE VEINS BY SUBCUTANEOUS SECTION.

By Henry Lee, F.R.C.S.,
Surgeon to King's College Hospital and the Lock Hospital, &c.

WHEN blood is effused in the living body, it undergoes changes varying according to different circumstances. Sometimes it is simply absorbed, leaving the parts into which it was effused unaltered in structure. Sometimes the fibrin is separated from the more fluid parts of the blood, and remains after these are removed; at other times a kind of sac may be formed around the effused blood, which will then remain for weeks or months of a dark grumous colour, undergoing little apparent alteration. Again, the parts containing the effused blood may suppurate, and the blood, more or less deprived of its colouring matter, may be discharged as from an abscess; or finally, the effused blood may undergo various degrees of decomposition.

Blood which remains stagnant for any lengthened period in veins is subject to similar changes. It may be deprived of its serum, and its more solid parts may remain, obstructing the vessel in which it is contained, for almost an unlimited period. Or in the fibrin so separated, cell development may take place; the mass will then become softened from the centre to the circumference, and there will be the appearance of an abscess in the vein; or, again, the stagnant blood may decompose.

In the various operations which have from time to time been practised, for the purpose of obliterating varicose veins, the products of these various alterations have occasionally become absorbed and mixed with the circulating blood, and when that is the case it is now well known with what severe and often fatal symptoms such an occurrence is manifested.

The occasional, although rare occurrence of the symptoms of blood poisoning, after operations on the veins, has led surgeons at intervals to seek for means of preventing the dangers previously experienced.

In the year 1816, Sir B. Brodie published a paper in the Medical and Chirurgical Transactions, in which he advocated the subcutaneous division of varicose veins. In that paper the advantages of the subcutaneous mode of operating are clearly pointed out. "The experience of the surgeons of that day," Sir B. Brodie observes, "had established the fact that the

mechanical injury of the trunk of one of the large veins, was liable to be followed by inflammation and a fever of a very serious character; and that the occasional occurrence of these symptoms after ligature, or even a simple division of the vena saphena, had occasioned surgeons to be cautious in performing these operations."

In some cases, Sir B. Brodie applied the caustic potash so as to make a slough of the skin and veins beneath it, but he found the relief which the patient experienced from the cure of the varix, to have afforded but an inadequate compensation for the pain to which he was subjected by the use of the caustic, and the inconvenience arising from the tedious healing of the ulcer which remained after the separation of the slough.

In other cases, Sir B. Brodie made an incision with a scalpel through the varix and the skin over it. This destroyed the varix as completely as it was destroyed by the caustic, and was found to be preferable to the use of the caustic, as the operation occasioned less pain, and as the wound was cicatrized in a much shorter space of time.

After performing this operation in several instances, Sir B. Brodie adopted the plan of dividing the varicose vessels without dividing the skin; the wound of the internal parts was thus placed under the most favourable circumstances for being healed, and the patient avoided the more tedious process of the cicatrization of a wound in the skin. In this improved operation, it was found that the patient experienced pain which was occasionally severe, but this subsided in the course of a short time. There was always hæmorrhage, which would have been profuse if neglected, but which was readily stopped by a moderate pressure, made by means of a compress and bandage carefully applied; after this operation it was recommended that the patient should be kept in bed for four or five days. In every case in which this operation had been performed, at the period at which the paper above-mentioned was written, it was followed by the obliteration of the varix. Sometimes no vestige of the divided veins could be afterwards distinguished; at other times they remained for a certain period full of coagulum, which was gradually absorbed. This was supposed to depend upon the greater or less degree of pressure, which was used after the subcutaneous division of the vein, and the nicety with which that pressure was applied.

The difference between dividing a varicose vein by subcutaneous incision and dividing it, together with the skin covering it, Sir B. Brodie observes "corresponds to that which exists between a simple and compound fracture." Now, in this mode

of performing the operation, great as its advantages appear to be over those previously in use, there is no adequate provision against hæmorrhage from the divided vessels on the one hand, nor, on the other, against the absorption, through the open mouths of the veins, of the products of decomposition, or of other changes to which the stagnant blood is liable. It is quite true, that even when such morbid actions do take place in the blood of an injured vein, that the effects may be circumscribed by the unassisted powers of nature. The vessels may be closed so that no absorption through its canal can take place, and thus the disease may be localized.

In like manner an artery, when divided, may cease to bleed spontaneously, but nevertheless surgeons are very unwilling to leave the result in such instances, to the unassisted powers of nature. In one case, as in the other, that which may possibly or probably be produced by natural causes, may with certainty be effected by artificial means; the veins, like the arteries, may be safely and efficiently closed. When provision is not made against their remaining open, accidents in one instance, as in the other, may occur; and accordingly we find that even as early as the date of the paper above mentioned, two or three cases of inflammation of the adipose and cellular membrane had taken place (even with the improved mode of operation), producing pain and tenderness of the limb, and a slight degree of fever. In these cases "the wound failed to become united by first intention." In two other instances the operation was followed by an attack of erysipelas. With regard to operations on the vena saphena major, the experience was still more unfavourable. We are informed in a subsequent lecture, published by Sir B. Brodie, that "Sir Everard Home recommended the application of a ligature, where the veins of the leg were varicose, to the vena saphena. The skin was divided, a silver needle armed with a ligature was passed under the vein, and the vein tied. In many instances at first no ill consequences ensued, but by and by a private patient of Sir Everard Home became affected with venous inflammation, and died. The same thing occurred in another patient. There were two women on whom the operation was performed, on each of whom venous inflammation, attended by typhoid symptoms, supervened; fortunately they did not die, but they had a very narrow escape. The operation was performed by other surgeons, and in their hands also it was found that every now and then, venous inflammation was brought on, which ended fatally. The operation was then generally abandoned."

Mr. Abernethy was of opinion that it was the ligature of

veins that produced the inflammation, but that they might be divided with impunity. Acting upon this idea, Sir. B. Brodie cut across the saphena vein and applied a vein compress. Sir B. Brodie informs us, with characteristic candour, that "the patient had venous inflammation, attended with very severe typhoid symptoms, and died within four days after the operation." Since then, observes Sir B. Brodie, no operation has been performed on the vena saphena, either by ligature, or in any other way.

Having been convinced, from observation and experiment, that the serious symptoms which occasionally arose after operations on veins depended upon the admission of diseased secretions, or the products of decomposition into the circulating blood, I determimed to try a new method of performing these operations. In the year 1853 I adopted the plan, before dividing the vein, of placing a needle under the vessels, in the way recommended by Velpeau, both above and below the part to be divided. Ligatures in the form 8 was then passed round the ends of the needles and over the vein. These were allowed to remain for a couple of days; at the expiration of this time the blood was usually coagulated in the vein, which could be felt as a round cord on either side of, and between the needles. The vein was now divided by subcutaneous incision, and two days later the needles were removed. At the expiration of three or four more days, union by the first intention had completely taken place, and the patient was allowed to go about his usual occupation. But here I am bound to state that in some of my first operations I was not so successful as I could have wished: one case in particular had some very severe local and constitutional symptoms, and I had reason to believe that an abscess had formed in the saphena vein, where it had been transfixed by one of the needles. Upon consideration, the cause of the mischief became apparent, the needle had traversed the vein instead of being made to pass fairly under it. The consequence was, that its cavity was not obliterated, and the blood changed in character, or mixed with the morbid secretions from surrounding parts, could find its way, between the needle and one side of the vein, into the general circulation.

The following may be given as an example of the effects of this mode of performing subcutaneous section of varicose veins:

Case I.

Henry McKnight, æt. 40, single, a Private in the 64th Regiment, came under my care, in King's College Hospital, on the 18th of February, 1857.

About five years previously he found the left saphena vein began to swell, in consequence as he supposed of heavy marching. He did not, however, come under medical treatment until six months before his admission into King's College Hospital. He was then admitted into Fort Pitt Hospital, and ordered an elastic stocking. Six weeks later, the varicose condition of the veins continuing, he was discharged from the Army as unfit for further service. Having lost his occupation, it became of much importance to him to be cured. When he came to King's College Hospital a tumor of the saphena vein presented itself over the internal condyle of the femur, about the size of a chesnut. This was covered by very thin integuments, and a fear had often been expressed that it would burst.

On the 21st of February two needles were passed under the dilated vein below the knee; and under a dilated branch on the outside of the leg, respectively. On the 25th the vein was divided subcutaneously between the needles in both situations. On the 27th the needles were withdrawn, and on the following day he was able to get up, union by first intention having taken place. The object of this first operation was to obliterate the branches before the trunk of the saphena vein was interfered with. This having been accomplished, on the 9th of March three needles were placed under the varicose saphena vein, and on the 11th this vessel was subcutaneously divided in two places, between the needles. The needles were withdrawn on the 13th. This patient left the hospital on the 30th, the swelling in the course of the vein being quite firm, and the vein having been completely obliterated.

In this mode of performing the operation the obliteration of the vein is secured by a coagulum being formed in it before it is divided. But it is evident that the same object can be attained by needles introduced under the vein, with proper care. When this is accomplished, there is no necessity to wait until the vein is obstructed by coagulum before performing the operation of subcutaneous section; and accordingly, at the suggestion of my colleague, Mr. Bowman, I have now on several occasions divided the vein immediately after introducing the needles. The small quantity of blood situated between the needles at the time of the operation is allowed to escape, the sides of the vein fall together, and the whole heals by first intention,—at least it has done so in all the cases upon which I have operated. But even should suppuration occur at the seat of the wound, the vein being closed above and below, no morbid secretion could find its way into the circulation.

The following are some instances in which this last mode of operating has been adopted.

Case II.

G. H., æt. 31, a man-servant, was admitted into King's College Hospital, on the 3rd of August, 1857.

There was then a large bunch of veins which latterly had become painful at the lower and inner part of the left thigh, and another at the inner side of the leg just below the knee.

Some fine needles were passed under the varicose veins both above and below the knee, and the vessels between the needles in both situations immediately afterwards divided. The operations were performed on the 8th of August. On the 10th, he had scarcely any pain, and his health was not at all affected. 12th. The needles were removed, and a pad of lint was secured by a bandage in the line of the vein. There was no inflammation and no pain in the part. He left the hospital quite free from pain, with the diseased vein apparently obliterated, on the 23rd of August. This patient presented himself on the 25th of March, 1858. Some branches of the saphena in the lower part of the thigh were somewhat dilated. He has suffered no pain nor inconvenience since the operation.

Case III.

H. B. was admitted into King's College Hospital, on the 22nd of August, with varicose veins of the right leg. Bunches of dilated veins were situated about the ankle, in the calf of the leg, and on the inside of the thigh.

On the same day two needles were placed under a single vein situated immediately below the knee, and a 8 ligature applied round their extremities. The vein was then divided by subcutaneous section; a pad of lint was applied over the course of the vein, and retained in its position by a strap of adhesive plaister. The needles were removed on the 26th, and the pad of lint was continued. There was now scarcely any pain, tenderness, or swelling about the parts: general health unimpaired.

On the 2nd of September he left the hospital. There was then some general thickening in the line of the subcutaneous incision. The vein was here to all appearances perfectly obliterated. There was no tenderness or pain in any part of the leg.

The above are instances of cases treated under favourable circumstances; and, as a contrast to them, I may mention the following example, which occurred in circumstances as disadvantageous as could well be conceived.

Case IV.

J. S., æt. 42, a fat, unhealthy-looking man, who had lost all his upper teeth, together with the alveolar process of the upper jaw, came under treatment on the 13th of May, 1857. He had several irritable ulcers on his right leg, which he attributed to having "poisoned" his leg, by his stocking having eaten into a wound some time previously. The veins on the inner part of the leg were greatly enlarged. The internal saphena was also enlarged, tortuous, and much dilated at one part. The varicose enlargement of the veins in the leg and in the thigh communicated by a single enlarged vein, running on the inner side of the knee. This patient, having a business to look after, was unwilling to lay up, but anxious to have the dilated veins cured.

On the 13th of May two needles were placed under the saphena vein, at an interval of about an inch and a-half, and the vein was divided by subcutaneous incision between them. The small quantity of blood which the vein between the needles contained was allowed to escape by a small wound in the skin; a pad of lint was then strapped over the vein between the needles, and the patient continued about, looking after his business.

On the 15th the needles were removed, but the pad of lint compressing the divided vein was allowed to remain. Some portions of the skin appeared more irritable than before, but there were no constitutional symptoms.

May 20. Had experienced numbness and pain in the leg since last report: an abscess had formed on the outside of the leg. The puncture made by the lower of the two needles was red, and discharged a small quantity of pus—the pulse was not excited; the appetite bad; no constitutional disturbance. The skin on the lower and outer part of the leg was covered with numerous superficial pustules resembling ecthyma.

May 22. He complained of the skin on the outer side of the leg being extremely sore and tender.

May 25. A small abscess had formed and burst on the inner side of the leg. He still complained of soreness round the ancle and outside of the leg.

May 28. Another small abscess had formed on the lower and inner part of the leg. There were still no constitutional symptoms.

June 1. The absorbents on the front of the thigh inflamed, their course being marked by red lines upon the skin. There

was no acceleration of the pulse, nor thickening nor other affection of the internal saphena vein.

June 4. The redness in the thigh had subsided; the irritation of the skin of the leg below the knee was much less. There had been throughout no shivering nor constitutional disturbance. He now went about his business as usual, the saphena vein being completely obliterated. In the beginning of July, while at work, he struck his ankle against a coal plate, and was obliged to go home from the pain. The following night he had a severe rigor—the part injured became affected with diffuse cellular inflammation, and a considerable portion of the cellular tissue sloughed. This circumstance is mentioned as showing in what an unhealthy condition the patient was—the most likely, one would have thought, for venous inflammation to have supervened; and yet this patient had the operation performed, although with a considerable amount of local irritation, yet without any constitutional disturbance.

The operation which I have advocated has, with various modifications, now been performed a great number of times by different surgeons, and, as far as I know, no serious symptoms have supervened, where due care has been taken that the sides of the vein should be brought together without being injured by the needles. It will be observed that in this communication I have not entered into the propriety, or otherwise, of performing operations on varicose veins; but in cases where such operations are performed, that which I have to advance may be included under two heads.

1. That the serious symptoms which have theretofore occasionally followed operations on the veins, depend upon the transmission of some morbid secretions, or blood undergoing certain changes, along the channels of the veins to the general circulation.

2. That provided such transmission be prevented, veins may be subcutaneously divided without fear of constitutional symptoms.

The impunity with which the saphena vein may be opened, when its canal is no longer pervious, is further illustrated by the following case :—

Case V.

Robert Hamin, æt. 51, came under my care at the King's College Hospital, in November, 1857. He had suffered for many years from a varicose condition of the veins of the right

leg. The trunk of the saphena alone was distended in the thigh, but below the knee several clusters of veins were much enlarged in different situations. When he applied at the Hospital the blood in the saphena vein had become spontaneously coagulated; a hard cord could be felt for five or six inches above the knee, and for two or three inches below it. The course of the vein was marked by a dark blush, which faded gradually into the colour of the surrounding skin. The patient experienced much pain in the course of the affected vein. He was advised to come into the Hospital, and rest the leg: this, however, he stated it was impossible for him to do, and accordingly he was treated as an out-patient. Shortly after his first application at the Hospital, a distinct sense of fluctuation presented itself in the vein, two or three inches above the knee. The pain had now increased, and the livid blush had become more decided. It appeared evident that the clot of blood in the vein had become softened, and was proving a source of irritation to surrounding parts. The vein was therefore freely opened, and a large quantity of grumous semi-fluid blood escaped. A pad of lint and some strips of plaster were applied over the wound, and he was allowed to walk home as usual. The skin appeared to unite by the first intention, but subsequently the wound opened, and for several days a quantity of bloody fluid was discharged. Water dressing was now applied; the tenderness of the skin continued for several days, and then entirely subsided, and the wound healed. In January, 1858, the saphena vein in the upper part of the thigh had regained its normal size, and the veins in the lower part of the leg were much reduced. On the 1st of March this patient again presented himself: the lower part of the saphena vein was completely obliterated, and the other veins previously distended, remained so far reduced as to give him no trouble. He had suffered no inconvenience since the last report.

ORIGINAL RESEARCHES

IN

PHYSIOLOGY AND MORBID ANATOMY.

ON EXCRETINE:

A NEW IMMEDIATE PRINCIPLE OF HUMAN EXCREMENTS.

By W. Marcet, M.D., F.R.S.,
Assistant-Physician and Lecturer on Chemistry to the Westminster Hospital, &c., &c.

IN 1853, being engaged with investigations into the composition of human excrements, I noticed in them, for the first time, the presence of a new substance possessed of peculiar and interesting properties, which I proposed subsequently to call *excretine.** The following circumstance led to its discovery :—With the view of endeavouring to separate, by mechanical precipitation, the fats contained in an alcoholic extract of fœces, lime-water was added to it, which enduced the formation of a precipitate. By collecting this precipitate on a filter, and exhausting it with ether, I expected to obtain an ethereal solution of such neutral fats as might have existed in the alcoholic extract; the result, however, was different from that I had anticipated, for, instead of fatty matters, the ethereal extract of the precipitate yielded, by spontaneous evaporation, an impure coloured residue containing a crystalline substance whose properties were not found to be the same as those of common fats,—this was *excretine.* After many unsuccessful attempts to obtain it by an easier and cheaper process, in order to examine its chemical properties, composition, and physiological relations, I accidentally observed that in very cold weather, when the thermometer descends below the freezing point excretine crystallizes directly in a concentrated alcoholic extract of fœces, and I took advantage of the cold weather in the winter 1855–56, to prepare by such means a quantity of this substance. Still, much trouble was experienced in obtaining it pure, and the specimen I had to operate upon being insufficient for allowing the examination of its properties, I finally undertook to extract another quantity of the substance

* See "Phil. Trans." for 1854.

by adopting the first method somewhat modified, which yielded very satisfactory results. The following is the process in question :—

The evacuation, if possessed of the usual healthy consistence, is at once introduced into a long-necked glass flask, to be exhausted with boiling alcohol; if fluid, it is first to be concentrated on the water-bath to the degree of consistence of solid fœces. It will be found very convenient to prepare the alcoholic extract in a vessel similar to a coffee strainer, where the fluid solution is separated from the insoluble residue by means of atmospheric pressure; this method has the advantage of saving a great deal of trouble and time, of requiring less alcohol, and of yielding a much purer alcoholic extract: the mass is to be extracted with small successive quantities of alcohol, sp. gr. ·850, until it has quite lost its pasty nature. The clear alcoholic fluid being allowed to remain undisturbed for 12 hours, or longer, is decanted from the deposit which has occurred, consisting of lime and magnesia soaps, and earthy phosphates, and the deposit is thrown on a filter in order to lose none of the alcoholic extract. The fluid is now to be mixed with a small quantity of thick milk of lime just prepared from the pure caustic substance, and is next diluted with a bulk of water equal to that of the extract, the whole being subsequently thoroughly agitated with a glass rod. After the lapse of a few hours, it will be noticed that a light precipitate has subsided to the lower part of the vessel; I now proceed to filter the whole mixture, in order to separate the lime precipitate, wash it several times with water, and dry it in the water-bath. The dry substance being removed from the filter, is introduced into a dry glass flask, and alcohol added to it; finally, a little ether is poured into the flask, which greatly increases the property possessed by the alcohol of dissolving the excretine contained in the lime precipitate. After shaking the contents of the flask from time to time for several hours, the fluid part is thrown on a filter, and more alcohol and ether are mixed with the residue in the flask, the solution being again filtered after some hours. In order to separate the whole, or at all events the greatest portion of excretine from the lime precipitate, it will be necessary to repeat three or four times the above-mentioned operation.

The clear filtrate, or alcoholic extract of the lime precipitate, is now to be exposed to the air in an open capsule, and placed in as cold a spot as possible. If the fluid contains a very large proportion of excretine, the substance will begin crystallizing after a few hours, but usually 24 hours or two days elapse

before the crystals appear. Two or three days after the crystals have begun forming, they are to be collected on a filter, the clear filtrate being again left undisturbed. Another crop of crystals will now occur in the mother liquor, which is again to be separated by filtration; finally, a third crop of crystals may be obtained in the fluid. In order to submit this impure excretine to a process of purification, it is now dissolved in hot alcohol, and the solution mixed and agitated with animal charcoal, to be subsequently filtered through a filter containing another quantity of charcoal, when it will be found to have become considerably discoloured. The filter washed with hot alcohol, and then with ether, yields most of the excretine remaining in the charcoal, and the solution is again to be left undisturbed for some days, in order to allow the substance to crystallize; if not yet colourless, it must be made to go through a second similar process of purification.

The first crystals of excretine that appear in an alcoholic solution of this substance, are very light and slender, floating in the fluid, they gradually become larger, adhering to the sides of the vessel, and grouping themselves in small tufts, diverging from the centre periphery; the free portion of the tufts floats in the fluid, and is so delicate as to be readily broken up should the vessel containing them be shaken. As the alcohol evaporates, the crystals become larger; the tufts now cover the sides of the vessel, filling the mother-liquor with a network of acicular colourless crystals, exhibiting a beautiful silky appearance if seen by transmitted light. When the whole excretine in the solution has been deposited in the crystallized form, if the mother-liquor was previously colourless it is to be decanted, and the substance dried under the air-pump. From the very delicate nature of the crystals, their microscopical examination is attended with some difficulty; they consist of acicular four-sided prisms, varying greatly in size, the largest being distinctly visible with a low magnifying power. (Fig. 6).

Excretine is insoluble in water, hot or cold, and when suspended in boiling water is converted into a yellowish resinous mass floating on the fluid. It is sparingly soluble in cold alcohol, but dissolves readily in hot alcohol. It is very soluble in cold or hot ether. The reaction of its alcoholic and ethereal solution was found in my first experiments to be slightly alkaline, but from the remarkable analogy existing between this substance and cholesterine, which is neutral, I have been induced of late to inquire into the accuracy of this result, by repeating the investigation on a larger quantity of excretine than that I had at hand on the previous occasion, the substance being very

carefully purified by means of animal charcoal, and subsequent washing with distilled water. It was now very difficult to determine whether even a saturated solution of excretine in ether or alcohol was alkaline or neutral. A slip of red test-paper turned very faintly blue when allowed to remain in an ethereal solution of excretine while evaporating spontaneously to dryness. A very concentrated alcoholic solution appeared without action on red or blue test paper. Heated on a platina spatula excretine fuses, evolving a peculiar aromatic smell, and leaving a brown stain, which, on the further application of heat, is completely removed, shewing its entirely organic nature. The crystals fuse at between 92° and 96° Cent., on becoming cold the substance may be noticed to have acquired a resinous consistence, and exhibits no crystals. It is not acted upon when boiled in a solution of potash or soda, or when treated with dilute sulphuric or hydrochloric acid. With boiling nitric acid, however, it is decomposed, giving out fumes of nitrous acid. Excretine is not at all hygroscopic or subject to decomposition, and can be preserved for years in a glass stoppered bottle.

The quantitative chemical composition of excretine was not established till last year,* on account of the difficulty I had experienced in obtaining a sufficient quantity of this substance for the analysis; its constituents are *carbon, hydrogen, oxygen,* and *sulphur;* it contains no water of crystallization. The carbon, hydrogen, and oxygen were determined by means of combustions with chromate of lead, and the proportion of sulphur was ascertained in the usual way, by burning excretine with carbonate of baryta and nitrate of potash. The following are the results from two analyses:—

	I.	II.	Average.
Carbon	80·412 ..	80·442	80·427
Hydrogen	13·746 ...	13·284	13·515
Sulphur	2·780 ...	2·780	2·780
Oxygen	3·062 ...	3·494	3·278

No substance having been found, as yet, to combine with excretine, its atomic composition was calculated from the assumption that one equivalent contained one equivalent of sulphur, and the following formula was obtained:—

78 Equivalents of Carbon	468
78 Equivalents of Hydrogen	78
1 Equivalent of Sulphur	16
2 Equivalents of Oxygen	16
Atomic weight of Excretine ...	578

* See "Phil. Trans." for 1857.

	Found.		Calculated.
Carbon	80·427	......	80·969
Hydrogen	13·515	......	13·495
Sulphur	2·780	......	2·768
Oxygen	3·278	......	2·768
	100·000		100·000

It will be now observed that excretine is a new animal substance, for although resembling the crystallizable fats *stearine* and *margarine*, it differs from them as to its fusing point, which is much higher, by its not assuming the crystallized form as soon as it becomes cold, by its not being acted upon by caustic potash or soda, and finally, from its having a different chemical composition. It appears to be closely allied in its properties to cholesterine; but its fusing point is much lower than that of cholesterine, which fuses at 140°, moreover, it does not crystallize in tabular crystals like cholesterine (fig. 7), and contains sulphur. To conclude

FIG. 6.

Crystals of Excretine, obtained by evaporating an alcoholic solution at a low temperature. The stellate collections are magnified 5 diameters. The prisms, on the right 215 diameters.

FIG. 7.

Crystals of Cholesterine. × 215

the chemical history of excretine, it is remarkable that in fœces it is very little liable to spontaneous decomposition, as I have found it in excrements long after their having been passed. Finally, it might be observed, that the method described above for the extraction of excretine will admit of this substance being detected in very complex mixtures; thus I have been able, by such means, to extract it in comparatively large quantities from my laboratory water-closet

drain, where it was mixed with decomposed urine, dust, paper, and other filth. With regard to the chemical form excretine assumes in human excrements, its property of crystallizing directly in their alcoholic extract, under the influence of cold, is a positive indication that it exists therein, in the uncombined state, and consequently this substance is an *immediate principle* of the human body.

The physiological relations of this interesting substance: its formation in the body, functions, and elimination, have also been investigated, but the results obtained are very incomplete, from the circumstance that, as I failed to detect it in any other but human evacuations, no very important results could be expected by experimenting on animals. Moreover, it is extremely difficult to procure for examination the intestines of a perfectly healthy individual, and consequently I have been obliged to confine these researches to the examination of various parts of the animal body, and to an inquiry into the composition of the castings of animals. The blood, spleen, liver, muscular tissue, bile, and urine, were submitted to analysis, but in none of these instances did I succeed in extracting excretine. The investigations on the blood and spleen lead to the detection of cholesterine in these parts; it was found in comparatively large quantities in the spleen, a fact interesting in a physiological point of view. In one instance cholesterine was obtained from bile by the same process.

The castings of the following animals were submitted to analysis, but in no case was the presence of excretine detected: the tiger, leopard, dog, crocodile, and boa; horse, sheep, dog fed on bread, wild boar, elephant, monkey; and finally, those of fowls. The castings of crocodiles were found to contain a large proportion of cholesterine, a remarkable circumstance, considering that I had not observed this substance to be present in any other excrements I had previously analysed. In the course of these researches I also had an opportunity of observing that the castings of carnivorous animals contain butyric acid, which I had not found to exist in human fœces.

I am still, therefore, at a loss to account for the formation of excretine in the human body: it is probably a produce of the intestinal secretions, and a form under which free sulphur is eliminated from the body without undergoing any process of direct oxidation.

I have been very ably seconded in these investigations by my assistant, Mr. Frederick Dupré, Ph. D.

OBSERVATIONS

ON

TUMOURS CONNECTED WITH BONES.

By J. W. Hulke, F.R.C.S.,
Assistant-Surgeon to King's College Hospital; Medical Tutor in King's College, London.

Plate xiii.

THE great interest which is felt in this subject both by the pathologist and by the practical surgeon, has induced me to communicate the following notes of some cases which have occurred in King's College Hospital, during the last few years, illustrating some of the most important varieties of these tumours. For the history of these cases I am indebted to my former teacher and colleague, Mr. Fergusson, who has placed his hospital case-books at my disposal for this purpose; whilst the microscopical details are taken from my own memoranda, written at the time of observation. I am fully aware that these notes are very fragmentary, and might have been more methodically arranged; but I would offer, as some excuse for this disconnectedness, the plea that they have been taken from time to time as cases have presented themselves, without reference to any special study of these affections.

TUMOURS COMPOSED ENTIRELY OF BONE.

Tumours and outgrowths, composed wholly of bone, are instances of hypertrophy, or are examples of cartilaginous and fibrous growths which have undergone complete ossification. Hypertrophy affects sometimes the compact, sometimes the cancellous tissue. To use Mr. Stanley's own words:—"This is a condition which consists of an increase of size from the augmentation of its healthy tissue." Leaving out of consideration, for the present, those instances of hypertrophy which occur in the neighbourhood of diseased joints, and in the vicinity of necrosis, in which we can trace the relationship of cause and effect, there are other examples in which we are quite unable to assign any reason for the exuberance of growth: this is particularly the case in hypertrophy of the bones of the face, amongst which the upper jaw is, perhaps, most commonly affected. Hypertrophy of the upper jaw usually occurs in young subjects, a fact which has led some persons to attribute it to irritation connected with a faulty condition of the teeth,

and this especially when the alveolus is the part chiefly affected; yet, on the other hand, it often begins far away from the alveolus in the body and the nasal process of the bone.

Case I.

Bony Tumour of the Upper Jaw with a Tooth embedded in it. Hypertrophy.

Eliza C——, æt. 13, was admitted into King's College Hospital, May 14, 1856, with a hard tumour of the left upper jaw, involving the alveolus, but not encroaching upon the palate, nose, or orbit. It had been growing for three years. It was removed by Mr. Fergusson, and was found to consist entirely of firm bony tissue, with a tooth embedded in it.

Case II.

Bony Tumour of the Upper Jaw. Hypertrophy.

Elizabeth H——, æt. 16, was admitted into King's College Hospital, 12th June, 1856, with a tumour of the right upper jaw-bone. It was first noticed a year before her admission. It involved the body of the jaw, the nasal, and the alveolar processes; it had pushed the lower turbinated bone inwards towards the nasal septum, but it did not encroach upon the cavity of the mouth. The malar bone was more prominent than natural, but did not seem to be itself implicated by the growth. The tumour was removed by Mr. Fergusson, and was found to be composed entirely of compact bony tissue, without any traces of a cartilaginous or fibrous matrix. The Haversial canals were very large, irregular in outline, and very frequent inosculations were seen; the septa between the canals were proportionally narrow, and the osseous tissue wanted the regular lamination peculiar to the Haversian systems of normal bone; indeed, concentric lamination could be observed only in the immediate vicinity of the vascular canals. The appearances closely resembled those which are found in the very vascular bone from the neighbourhood of sequestra.

BONY TUMOURS HAVING A CARTILAGINOUS ORIGIN.

Bony tumours having cartilage for their primogenial tissue naturally arrange themselves in two great classes: these comprise some forms of exostoses on the one hand, and the enchondromatous tumours on the other. Whilst they resemble one another in having a common cartilaginous origin, they differ in almost every other particular; and, indeed, even the

cartilage presents great differences of structure. The cartilage of a growing exostosis in its elementary structures, and in its mode of ossification, closely resembles normal temporary cartilage; and the bone, as Mr. Paget has remarked in his "Lectures on Surgical Pathology," is strikingly like the osseous tissue of that part of the skeleton from which the exostosis springs. In enchondromata, however, the cartilage and bone have a much less perfect character; the intercellular substance of the cartilage presents great varieties of consistence, sometimes it is as soft as jelly; the cells are often of very large size and frequently present the greatest variety of outline; the order of ossification is reversed, and earthy impregnation of the cells precedes that of the matrix. Mr. Queckett has shown that whilst exostoses have but one centre of ossification, enchondromata usually possess several. But besides these structural differences, there are others no less marked. The comparatively limited size which exostoses attain; the circumscribed, usually well defined, base of these outgrowths continuous with and closely resembling the bones from which they project; their purely local character and perfectly innocent nature; all these strongly contrast with the enormous, indefinite size occasionally acquired by enchondromata;* with the destruction of the normal bony tissue, and the substitution of their own less perfect tissues; and with their consanguinity with other growths of a manifest cancerous character, a feature which has been pointed out by Mr. Paget.

Case III.

Large Exostosis of the upper end of the Femur.

The patient, when a boy of about twelve years old, was brought to Mr. Partridge with a tumour in the upper part of the thigh, close to but not implicating the hip-joint. The precise nature of the growth seemed doubtful; for sometimes it slowly increased in size, but afterwards was stationary. Meanwhile he had an attack of rheumatism during which his heart was affected, and he died in 1857. At the post-mortem examination, the upper end of the femur was removed, and the tumour was found to be a good example of exostosis. Its rounded surface is nodular and grooved, and in the recent condition was covered with a thin layer of cartilage. It projects from the front and inner side of the shaft at the junction of the latter with the trochanters, both of which, and also the neck and

* A case recorded by Mr. Holthouse, in "Transactions Path. Soc.," vol. viii., weighed 30 lbs., and measured 42 inches in its longitudinal circumference, 25½ in its upper, and 29 inches in its lower.

head of the bone, are quite normal. The base is well defined; its upper boundary corresponds with the spiral or anterior inter-trochanteric line. The macerated specimen which I have before me measures horizontally, in its greatest circumference, ten inches and a-half, and vertically four inches and three-quarters. A vertical section shows a thin outer shell, enclosing cancellous tissue, continuous with, and resembling in outward appearance and in minute structure, the spongy tissue of this part of the femur. Some of the cancellous tissue is replaced by small medullary cavities. The thin outer shell resembles in all respects the compact bony tissue of the shaft and neck of the bone.

Case IV.

Ossifying Enchondromatous Tumour of the Tibia and Fibula.

Hezekiah R——, æt. , pale, feeble, and emaciated, was admitted into King's College Hospital, under the care of Mr. Fergusson, last spring, with a large tumour of the leg. It reached nearly from the knee to the ankle; but the articular ends of both tibia and fibula could be traced with the finger. Its surface was everywhere firm and nodular; the skin covering it was dusky, and the superficial veins were imbedded in deep grooves. Rather below the middle of the leg, at the inner side, there was a separate, slightly moveable, tumour, as large as an orange; he had first noticed it only six months before his admission. The circumference of the tumour, at the middle of the leg, was 22 inches, and its length, down the front of the leg, measured 14 inches. It was not painful, nor tender. He said that his mother had died of cancer of the throat eleven years ago. Mr. Fergusson removed the limb by a circular amputation at the knee-joint.

I have the following notes of the appearances. The tumour was sawn through longitudinally. It was a firm, solid mass, involving the shaft of the tibia, the upper and lower ends of which bone could be distinctly traced for some distance, but the central portion was lost in the surrounding structures. The articular extremities of both the tibia and fibula were unimplicated by the disease. The cut surface of the growth had a very peculiar mottled, nutmeg-like appearance, produced by the intermixture of spots of firm white bone with other more vascular and redder portions. The meshes of the bony framework were everywhere filled with cartilage, the matrix of which in the central parts of the tumour was firm and hyaloid, in some parts faintly striated, or granular and dark where it was undergoing ossification; whilst towards the outer surface, the matrix had a soft, almost jelly-like, consistence. The cartilage

cells, everywhere numerous, were large; and, as a rule, each cell contained only one nucleus, which almost filled it. Ossification of the cells seemed to precede that of the intercellular substance; and the ossified cells formed large plump lacunar cavities, with few and short canaliculi, or more commonly without any. (Plate XIII, fig. 1.) The bony tissue contained large vascular canals, but presented no indications of lamination. Here and there, there were small portions of the original bone, the regular lamination and perfect lacunæ of which contrasted very strongly with the appearances presented by the new formation.

After maceration, the bony frame-work formed a spongy foliated mass; the rough and tuberculated surface of which was mapped out into lobules by deep intervening fissures. The upper and middle thirds of the fibula were pushed outwards and flattened by the tumour which had filled the interosseous space, and the bone for three inches above the outer malleolus had acquired about three times its natural bulk.

The more perfect condition of the cartilage, and the more advanced stage of ossification in the deeper parts of the tumour, both favour the supposition that the cartilaginous growth began within the shaft of the tibia, and, in its progress outwards, gradually replaced the normal bony tissue, until, at length, all traces of the middle of the tibia had disappeared, and the softer jelly-like cartilage upon the outer surface of the tumour remained covered by periosteum only. This soft jelly-like condition of the cartilage is considered by some persons as a constant sign of degeneration; whilst others look upon it as evidence of a nascent condition. There is some truth in both these views; softening in the interior of a cartilaginous tumour is undoubtedly often a consequence of degeneration; whilst, on the other hand, a soft jelly-like consistence of the matrix at the surface is certainly in some cases a natural growing state.

It is interesting to notice the striking similarity which exists between the large roundish lacunar cavities of the growth (plate XIII, fig. 2), and those which are always present in the layer of articular bone, which intervene between articular cartilage and the vascular bony tissue. This layer, which has been particularly described by Kölliker, always contains dark, globular, or elongated bodies, singly, or clustered in lines perpendicular to the surface. (Plate XIII, fig. 6.) These dark objects are lacunar cavities; they become very faint, or entirely disappear when the slip of bone is moistened with turpentine; but they differ from perfect lacunæ by their different form, their large size, and by the absence of canaliculi. They appear to be the cartilage cells arrested in transition. This is readily proved by

moistening the specimen with acetic, or still better, with nitric acid, which dissolves out the earthy matter, and renders the cell wall and the nucleus distinctly apparent.

The appearances in the separate moveable tumour from the inner side of the leg, exactly resembled those of the larger growth. It was enclosed in a fibrous capsule, and had a narrow attachment to the fibrous covering of the larger tumour. This fibrous envelope sent inwards septa between the lobules, and ossification was proceeding from the centre towards the surface. The frequency with which cartilaginous and cancerous structures are mingled in the same tumour, considered in connection with the hereditary nature of the latter, gives interest to the fact of this patient's mother having died of cancer. The consanguinity of these affections has been already alluded to.

MYELOID DISEASE.

The comparatively recent date at which this disease has been distinguished from some other affections of bone to which it bears a close outward resemblance, induces me to preface the records of a case, with a short notice of the history of this affection.

Fibro-plastic, or sarcomatous, myeloid, myelo-cystic tumour of Bone.

This was first described as a distinct disease by Lebert, in his "Treatise on Practical Surgery," under the designation of fibro-plastic or sarcomatous tumour. He narrates twenty-seven cases which had come under his own notice, and describes the large poly-nucleated cells and fibro-plastic elements, characteristic of this disease.*

In 1849, Robin, in a memoir on the existence of two new anatomical elements which occur in the medullary canal of bone,† describes these large poly-nucleated cells as normal constituents of the osseous system, and also alludes to their occurrence in tumours of bone. Kölliker tells us that these cells are constantly present in fœtal marrow, and they occur more sparingly in that of adults.‡ From the affinity of the large poly-nucleated cells of the fibro-plastic tumours of Lebert with those normally present in marrow, Mr. Paget proposed the name of *myeloid*, for these growths. Mr. Gray, in the "Transactions of the Royal Med. Chir. Soc. 1856," has given a very

* Lebert. "Abhandlungen aus dem gebiete der Praktischen Chirurgie;" and also "Physiol. Path.," ii., 120.

† "Sur l'Existence de deux Espèces Nouvelles d'Eléments Anatomiques qui se trouvent dans le Canal Médullaire des os;" par M. Ch. Robin. Paris, Oct. 1849.

‡ "Mikrosk. Anat.," B. ii.

elaborate account of several cases of myeloid and myelo-cystic growths, with details of the minute structures composing them, and with remarks on their origin, and on the distinctions between these and other tumours of bone. Mr. Gray observes, that they commonly occur in young persons; and he appears inclined to place the starting-point of these growths in the large poly-nucleated normal marrow-cells. The case which I shall now describe, occurred in adult life, and a careful study of the elementary structures of the tumour seems to throw some light upon its origin and mode of growth.

Case V.

Myeloid Tumour of the Femur.

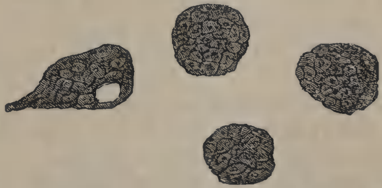
John Hill, æt 43, was admitted into King's College Hospital, July 23rd, 1857, under the care of Mr. Fergusson, with a tumour involving the right knee and lower third of the thigh. He gave the following history of himself: he was a serjeant in the 8th Foot Regiment, and had seen nineteen years of service, the last eleven of which he had spent in India. His health has always been good until the present affection. Eighteen months ago, whilst on a march, he felt pain in the right knee, which lasted for about three weeks, when acute inflammation of the joint supervened; this inflammation was subdued by appropriate treatment, and the swelling somewhat subsided, but again increased and became firmer. At the time of his admission the knee and lower third of the thigh were occupied by a large elastic swelling, most prominent on the inner side of the knee, and measuring fourteen inches round at its greatest circumference. At some parts of its surface harder portions, probably bony plates, could be felt. The natural outlines of the knee joint were quite lost, but the inner condyle of the femur could be felt, and the patella was floated up by fluid within the joint. The knee was semi-flexed, and admitted of slight movement, which, however, gave him great pain. He had occasional pain in the swelling, and it was tender when examined. No enlarged glands could be felt in the groin. He had an anxious, sallow, cachectic, look. Amputation was performed by Mr. Fergusson, and the patient left the hospital about a month afterwards, having made a most rapid recovery, and having quite lost his cachectic appearance.

This case presented many of the features of malignant disease; and indeed, after the removal of the limb, when a vertical section had been made through the tumour, the appearance bore considerable resemblance to those which a very vascular medullary cancer would exhibit; yet the disease was of

a very different nature; upon a minute examination it proved to be a marked instance of myeloid disease.

The condyles and lower end of the shaft of the femur were expanded into a thin bony shell, deficient at some places, and filled with a very vascular growth. The cartilage of the inner condyle of the femur was very thin, and a bluish growth from the interior of the bone projected into the knee joint, covered only with the thinnest film of articular cartilage; it looked not unlike a venous nævus. The joint contained two or three ounces of bloody serum. The whole tumour consisted of a soft substance, easily broken down under the finger. Its colour varied from a light buff, like that of decolorized fibrine, to a deep red or crimson. A clear fluid oozed from a freshly cut surface, quite unlike the creamy juice of cancer. The tumour contained very numerous cysts of all sizes; some of them were simple, others formed large irregular multilocular cavities, crossed and partially separated by projecting septa. The surface bounding these cysts and spaces was smooth and shining, the contents varied greatly; some contained clotted, others fluid, blood, and were not unlike large venous sinuses (I regret that I lost the opportunity of ascertaining whether they communicated with veins, by the accidental destruction of the specimen on the day following its removal), whilst others again were filled with a serous fluid. The elementary structures were highly characteristic. The solid tissues consisted almost entirely of myeloid structures. These were large poly-nucleated cells, brood cells, the cell wall of which was in some specimens very distinct, but in many instances could not be made out. The cells had an irregular branched outline, or were more or less circular or pear shaped. (Fig. 8.) The latter shapes prevailed. The nuclei

FIG. 8.



Myeloid cells from a soft tumour, the lower end of the shaft of the femur × 220.

were imbedded in a finely granular matrix; they were oval, and of very uniform size and appearance; they varied in number from five or six in a cell to ten or twenty; and in some of the cell-like masses, in which no containing membrane could be seen, the nuclei were so numerous, and so closely packed,

that they could not be counted. Fibro-plastic cells occurred in the superficial parts of the tumour, and were especially plentiful where the bony shell had disappeared, and the surface of the growth was bounded by the periosteum and fibrous tissues only. The changes which had occurred in the cartilaginous and bony tissues of the inner condyle seem to throw some light upon the development and growth of this disease.

In studying these changes I made thin vertical sections through the articular cartilage, the bone beneath it, and through the adjacent myeloid tissue. Where the cartilage had become thin and was implicated in the disease, the intercellular substance was dark and granular, and the cells had a large size. The nuclei of these cartilage cells by repeated subdivision furnished the clustered nuclei characteristic of the myeloid cell. (Plate XIII., fig. 4). Similar changes had taken place in the imperfect lacunæ, semi-transformed, cartilage cells which are always to be found in the articular layer of bone. In short the cartilage cells and lacunæ seemed to be transformed into the large brood cells, and cell-like masses of the new growth. In several instances the transitional change from the nucleated cartilage cell to the clustered nuclei of the myeloid could be distinctly traced. The bone was hollowed out into irregular cavities resembling Haversian spaces, which were filled with oval, circular, and club-shaped myeloid cells and masses (plate XIII., fig. 3), and these seemed to grow by a kind of outbudding of the granular matrix in which the nuclei were packed. (Plate XIII., fig. 5.) In short, the mode of growth was what Rokitansky has not inaptly termed dendritic. The diagnosis in this case was very obscure, but inclined to the supposition of medullary cancer, indeed, the general aspect of the tumour, its elasticity, and its rate of growth, together with the age, the sallow, cachectic appearance, and the anxious expression of the patient, all favoured this opinion, which was strengthened after removal of the limb, by the appearances which a section of the tumour presented to the naked eye. On the other hand the lymphatic glands were not enlarged, and the shaft of the femur was not infiltrated, and the growth had a distinct limit; but whatever doubts existed before as to the benign or malignant character of the growth, they were at once solved by the microscopical appearances. It is worthy of notice, that in the case I have just narrated, the myeloid mass did not contain any bony framework; and in those instances in which new bone is formed to any great extent, perhaps the fibroplastic, predominates over the true myeloid, elements.

ON THE LYMPHATICS OF THE LIVER.

By Lionel Beale, M.B., F.R.S.

PLATE XIV.

MANY unsuccessful attempts had been made to inject the lymphatics of the liver, before the plan which ultimately succeeded was adopted. I had been able to force injection for some distance along the larger trunks in the opposite direction to that in which the valves opened, but could not obtain satisfactory injections of the smallest vessels. The largest lymphatic vessels in the portal canals are often injected by rupture of the coats of the duct, and by extravasation of the injection, as Mr. Kiernan remarked in his paper. The same has many times occurred to myself, but under these circumstances the injection always runs towards the transverse fissure, in the direction which the arrangement of the valves permits the fluid to pass readily, and the smaller branches of lymphatics are never injected. The drawings in plate XIV were obtained from preparations which were made as follows: an ox liver was thoroughly injected with warm water from the portal vein, as if the ducts were to be injected; gradually the organ became distended, and much fluid returned by the lymphatic vessels. Many large trunks running over the surface were fully distended with water. Into one of these swollen trunks a small pipe was inserted with much difficulty, and the vessel was tied round it. The whole organ was wrapped up in cloths and subjected to considerable pressure for upwards of twenty-four hours. When the water had been absorbed, the lymphatic vessels were quite invisible, and it would have been impossible at this time to have found a trunk into which a pipe could have been inserted. A little of the Prussian blue injecting fluid was now forced into the pipe from a small syringe. It passed for some distance along the trunk of the vessel, and by pressing the large trunks a little from time to time, was made to pass the valves, and so forced into the smaller branches. By using slight but gradually increased pressure, the trunks were so distended as to render the meeting of the valves impossible. In the course of half an hour or longer, an abundant network of lymphatics upon the surface had been fully injected, without any extravasation. It was now considered desirable to wait awhile, before introducing more fluid. After a few hours the injection was resumed until as much fluid had been forced in as could be introduced without running the risk of rupturing the vessels. I have tried the same plan with the human liver, but hitherto with very

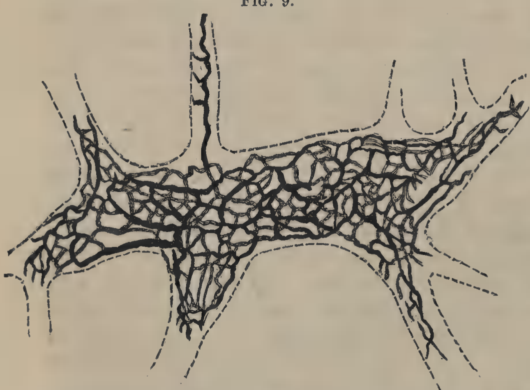
imperfect success, the trunks are much smaller, and their walls more delicate than those of the liver of the ox.

After the lymphatics had been injected as above described, thin pieces were removed for microscopical examination. Upon removing thin sections from the surface it was discovered that the injection had passed into many of the lymphatics of the portal canals, not only into the canals just beneath the capsule, but into some lying at the depth of an inch or an inch and a-half in the substance of the liver.

The general arrangement of the larger lymphatic trunks, the free communications between the superficial branches on the surface and the deep ones in the substance of the liver, and the course of the larger branches towards the thoracic duct, have been fully described, it is, therefore, unnecessary to discuss this part of the subject* in the present paper.

The lymphatics were generally injected with mercury, and although this process was well adapted for showing the course of the larger trunks, the great distension produced in them rendered it impossible to ascertain the arrangement of the smaller vessels, even supposing them to be injected; but the materials employed for injection seldom penetrated into the smallest branches. I know of no drawing or description of the smallest lymphatic vessels, either of the surface of the liver or the portal canals, and the appearances delineated in the accompanying woodcuts (figs. 9, 10), and in plate XIV, could only be

FIG. 9.



Lymphatics from a portal canal of the liver of the ox. Several small branches are seen passing along the smaller canals. × 15.

FIG. 10.

A portion of the net-work represented in fig. 9, more highly magnified. × 215.

obtained where a transparent injecting fluid had been employed, so that the specimen could be examined by transmitted light.

* Vide Quain and Sharpey's Anatomy.

The network represented in plate XIV, fig. 1, occupies several different planes, and lies partly in the substance of the fibrous capsule of the liver, and partly immediately beneath this structure. The smallest vessels have been injected, though in many situations not quite perfectly. There can, I think, be little doubt that the smallest branches form an intricate network. I have not been able to demonstrate the existence of blind extremities, although I am not in a position to assert that lymphatic vessels never commence in this manner. In plate XIV, fig. 3 some very narrow branches are represented, many not being more than 1-2000th of an inch in diameter. In the preparation from which this drawing was taken, a network is seen in many places, and the branches which do not absolutely communicate are in many instances exactly opposite each other, a circumstance which renders it more probable that the tube in the interval is uninjected, than that there are cœcal tubes lying immediately opposite. The point at which the injection ceases is ragged, and of the same diameter as the rest of the tube, while if there were commencing blind extremities, they would be rounded, and probably a little wider than the rest of the tube.

In many places the injection had accumulated in front of the valves, and had distended the tube very much, as represented in fig. 2, plate XIV.

In fig. 9, from a portal canal, the injection is perfect, although doubtless the tubes are distended beyond their natural extent. Here, evidently, there is a network entirely surrounding the vessels contained in the portal canals, and on either side of the large canal, smaller ones are observed to pass off. These also have their lymphatic vessels. No blind extremities can be found here, and if they existed, I think at least a few would be distinguished in a part of the preparation where the injection is evidently very perfect.

I have not been able to determine positively if branches enter the substance of the lobules from the portal canals, although many appearances have been observed which render this probable. In some places injection seems to have passed from the branches in the portal canal to some distance within the lobule, and, as far as I can make out, it is situated between the capillaries and the cell-containing network. There is no evidence of extravasation, and the appearance precisely accords with what one would expect to find if the above view were true. Nevertheless, I am unwilling to advance hypotheses or indulge in speculations as to the precise nature of an arrangement which is doubtless demonstrable, and think it better to wait the result of further investigation, before publishing the drawing of the appearance above referred to.

ON THE ARRANGEMENT OF THE VESSELS OF THE GALL-BLADDER, TRANSVERSE FISSURE, AND PORTAL CANALS OF THE HUMAN LIVER.

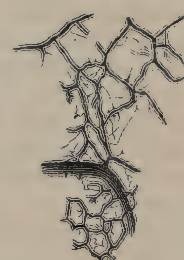
By Dr. Beale.

THE very peculiar arrangement of the vessels of the gall-bladder is referred to in my Monograph on the Liver, p. 29. The only author who had previously noticed this beautiful disposition of the vessels, is Professor E. H. Weber,* but he makes no mention of a similar arrangement of the vessels in the transverse fissure, and in the portal canals; and it is surprising that, at least as far as I can ascertain, no observer has yet figured the very remarkable disposition of these vessels.† The gall-bladder,

Fig. 11.

Vessels of the human gall bladder seen from the outer surface. The artery was injected with vermilion, and is the central vessel left white in the cut. The vein was injected with white lead, and is dark in the drawing. One branch of vein is seen on each side of every branch of the artery. One half larger than natural.

Fig. 12.



Vessels in a portal canal of the human liver injected. The *central dark* vessel is the artery. The veins have been left light. Two accompany each branch of artery as in the gall-bladder. Natural size.

the transverse fissure, and the portal canals are, as is well known, abundantly supplied with arterial blood, especially in the

* Annotationes Anatomicæ et Physiologicæ. Programmata Collecta Fasciculus II, p. 225. Berichte über die Verhandlungen der Königlich Sachsischen Gesellschaft zu Leipzig, No. III, 1850, s. 185.

† The arrangement in the transverse fissure of the vessels and vasa aberrantia of the human liver is represented in fig. 25 of "The Anatomy of the Liver," and in fig. 1 of my paper in the Phil. Trans. for 1855.

neighbourhood of the ducts. In these localities there exists an arrangement which permits the free circulation of the blood through the arteries, and facilitates its return into branches of the portal vein. Each branch of artery is accompanied by two branches of the vein, and this arrangement exists even in the case of very small divisions. The small branches of the arteries anastomose very freely, in some cases forming five or six-sided spaces, so that an arterial net-work is formed. This is met with on the external surface of the gall-bladder, fig. 11, in the transverse fissure, and in the portal canals. The vessels composing this net-work are accompanied on either side by a branch of vein. These also form net-works, and the two venous branches communicate freely with each other, by transverse branches which pass over or under the artery. The trunks of the veins and arteries are of course distinct, and the blood, as in other cases, passes through capillaries before it reaches the veins. The vessels described are from the 8th to the 20th of an inch in diameter. Such an arrangement of double veins facilitates the rapid return of the blood after it has passed through the arteries, and, as each branch of the vein is as large as the artery, would permit the return of a larger quantity of blood by the veins than was transmitted by the arteries in a given time, in case the volume of blood should have been increased by the absorption of fluid.

It is, I believe, almost universally held, that the arterial blood distributed to a gland is required for the nutrition of the structures of which the gland is composed, but such an hypothesis is quite insufficient to explain the large or small amount of arterial blood sent to different parts of an organ, nor does it account for the distribution of so large an amount of arterial blood on the walls of the gall ducts, or in the coats of an organ like the gall-bladder. Many facts tend to the conclusion, that this arterial blood exerts a very important influence in the process of secretion generally, and, in some instances, upon the secretion itself after it has been formed. It is certain that the bile is subjected to the action of arterial blood in every part of its course, from the smallest ducts with walls composed of the thinnest basement membrane, till its arrival at the common duct or gall-bladder. While it remains in this viscus no doubt further changes are exerted in it by the arterial blood so abundantly distributed to the mucous membrane. Besides this, in the peculiar arrangement of the veins, we cannot fail to see a special provision to promote the free return and very rapid renewal of this blood, although its bulk has been increased by the absorption of water from the bile. One large

vein would be much more likely to have the circulation through it impeded by pressure or stretching, than two smaller ones, and as the calibre of each of these veins is nearly the same as that of the artery between them, any circumstances tending to retard the return of blood in the veins, would also diminish the flow in the arteries, so that this arrangement provides, in the most perfect manner, for the free circulation of the blood under all circumstances.

ON THE MORBID CHANGES TAKING PLACE IN A CASE OF "CIRRHOSIS," WITH REMARKS UPON THE NATURE OF THIS DISEASE OF THE LIVER.

By Lionel Beale, M.B., F.R.S.,

PLATES XV, XVI, XVII.

Case I.—*Cirrhosis.*

THE man from whose body the liver was removed had been a patient in King's College Hospital, under Dr. Todd's care. There was nothing unusual or remarkable in this case, but it is an excellent example of cirrhose liver, which comes on from spirit drinking. The man had been a soldier, and afterwards a gentleman's servant. He was only 27 years old, and in early life had enjoyed good health. At about the age of 21 he commenced drinking spirits very freely, but for five years before his death, he said, he had been abstemious. About six months before his death he noticed he was getting very thin, and soon afterwards it was observed that fluid began to collect in the abdominal cavity. The ascites gradually increased, and about three weeks before his death it was absolutely necessary to relieve his distress, by drawing off the fluid, which amounted to nearly 30 pints. It again increased after the tapping up to the time of death. The urine had never been albuminous and its sp. gr. was 1010.

The liver presented the ordinary characters met with in this condition, although the changes had not advanced so far as is often observed. The surface was uneven and nodulated, of a pale blueish-white colour. The whole organ was much contracted, but the left lobe more than other parts. The heart and

other organs appeared healthy. This may be regarded, therefore, as a case of cirrhosis, uncomplicated with heart disease or other morbid conditions, and due, in all probability, to spirit drinking alone. The very large accumulation of fluid in the abdomen no doubt much hastened the fatal result.

I propose, in the first place, to give a short account of the changes which the organ had undergone in structure; and to consider afterwards the nature of the morbid alteration, and the order in which the changes have taken place.

In one part of the liver, a branch of the portal vein was injected; in another, a branch of the hepatic vein; and in a third, injection was forced into a trunk of the duct.

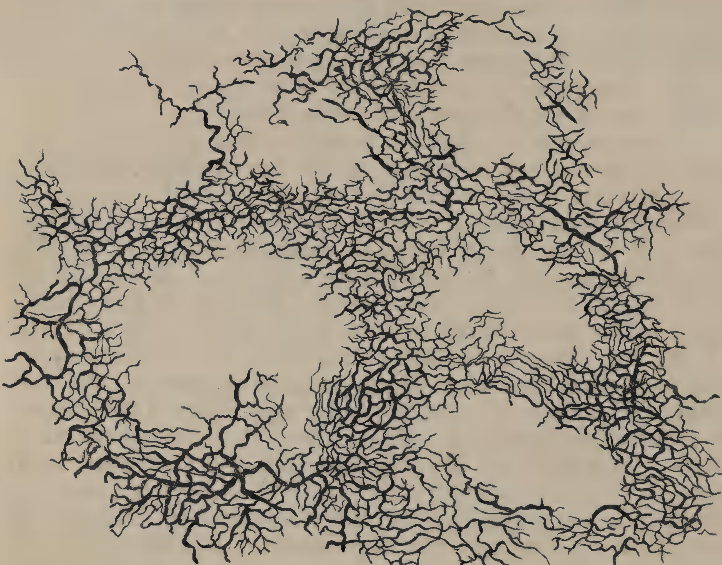
General description of a Section.—Upon examining a thin section of the uninjected liver, cut with a Valentin's knife, the appearances so often described were well seen. A number of small imperfectly circumscribed masses (lobules) of a brownish yellow colour were noticed in some parts of the section. (Plate XV, fig. 2.) They varied in size and form, and were separated from each other by a white fibrous-looking material, *a*, the diameter of which was as great or greater than many of the granular spaces above described. These brownish yellow spaces were clearly the remains of the lobules, while the partitions were evidently interlobular fissures, increased in dimensions, and occupied by a firm white material, like fibrous tissue. Lobules in every degree of wasting could be pointed out, and in some places all that remained was a minute speck, *b*. In other places the circumscribed portions were much larger, and evidently composed of a number of lobules, which had become much wasted, and were incorporated together. These are shown in the figure.

Portal Vein.—Upon examining a section of that part of the liver in which the portal vein had been injected, the portal canals and interlobular spaces were seen to be everywhere occupied by highly tortuous vessels, which in many situations formed a lax net-work. The branches were not so wide as the majority of the small interlobular veins in health. The injection extended to the margin of the lobules, and in some few instances penetrated for a short distance along the trunks of vessels which entered the lobule, but *no injected capillaries* in the interior of the lobule, as would have been observed in a healthy liver, could be demonstrated, fig. 13.

Fibrous-like structure between the Lobules,—generally regarded as Inflammatory Lymph or Fibrous Tissue.—The fibrous looking material which separates the wasted lobules from each other, and which is usually described as consisting of an inflammatory exudation which becomes fibrous, and by its contraction compresses the lobules, is penetrated in all directions by vessels

of considerable size. (Fig. 13.) There is, therefore, here no indication of any great *physical* impediment to the passage of blood through these same vessels.

Fig. 13.



This cut shows the portal vessels of the cirrhose liver injected. The lobules themselves are not represented, in order that the drawing may be as clear as possible. The spaces thus mapped out do not correspond to separate lobules, but contain several fused together as it were, The vessels represent those which run in the larger interlobular fissures in the healthy organ. Each space is completely surrounded by vessels, but no branches enter the lobule. × 15 diameters.

The fibrous-like material is not found between every lobule, but only at certain intervals. (Plate V, fig. 2.) Several lobules are in many instances fused together, so as to form one mass; the interspaces correspond to the larger branches of the vessels, ramifying in the portal canals. The smaller branches of the portal vessels between individual lobules have in many instances entirely disappeared, the lobules themselves having wasted away.

In a case of cirrhosis complicated with heart disease, the great vascularity of the fibrous-looking material between the lobules of the liver was demonstrated most satisfactorily by Backer,* in the year 1845. He describes their serpentine course and the network here and there formed by them, and gives an excellent drawing of the arrangement. In his paper, however, he describes the existence of plenty of capillary vessels in

* The inaugural dissertation on the minute anatomy of the liver in health and disease by Dr. Backer is one of the best essays on the subject. It contains

the interlobular fissures, so that where one or two branches were found in health, there existed a beautiful network. The last statement does not accord with my observations, neither, I think, does it agree with his own plate. The vessels which he describes as capillaries, are much larger than those vessels. Such a network certainly does exist in health, in the portal canals, but the diameter of the vessels is much less than these, and they are not so easily injected as in cirrhosis.

That this fibrous-like material is not of the simple character usually described, is shown by reference to fig. 5, plate XVI, which is an accurate copy of a preparation in which the structures it contained were very clearly demonstrated. The branches of the vein, *a*, had been injected with transparent injection, and between these were observed a number of tubes containing minute oil-globules and granular matter, *b*. These were obviously altered ducts. The preparation was compared with another in which the ducts had been injected with Prussian blue, and their nature was then placed beyond a doubt. Their mode of branching and the direction in which they run, as well as the nature of their contents, also show them to be ducts. Between these tubes, there certainly exists a small quantity of a material which is granular rather than fibrous. It is not composed simply of "fibrous tissue." In considering, therefore, the nature of the material intervening between the remains of the lobules, we must bear in mind that it contains numerous vessels and ducts, the presence of which can be demonstrated by injection; but besides these structures there must be a considerable amount of tissue, composed of altered and partly disintegrated vessels, cells, and other structures, which existed in these situations in the healthy condition of the organ.

Hepatic vein.—Upon making sections of that part of the liver in which the hepatic vein had been injected, the following points were observed: the small intralobular veins were injected in various parts, and served to mark the centre of the remains of the lobules; but only in a few lobules in which the wasting had proceeded to a very limited extent, were any capillary vessels to be discovered. In many lobules a branch or two, much larger than a capillary, were seen to pass from the centre towards the circumference of the lobule, and establish a communication with branches in the interlobular fissures. (Plate XVI, fig. 7.)

Capillaries.—In this case, then, the capillaries of the lobules had almost entirely disappeared, and it was only in a very few

many important observations by Professor Schroeder Van der Kolk. Although referred to by many writers on the anatomy of the liver, his observations on cirrhosis seem hardly to have received the attention they deserve. Dissertatio Medica inauguralis. Trajecti ad Rhenum, apud W. H. Van Heyningen. 1845.

lobules, which were not so completely disorganized, that any capillary vessels could be discovered. Even in these situations the capillary walls were granular, and contained very many oil-globules as represented in plate XVI, fig. 2. In other instances, a line of oil-globules and a little granular matter served to mark the position of capillaries at an earlier period of time, fig. 1, *b*; yet, in many instances the injection passed from the portal to the hepatic branches, by the intervention of one or two large tubes (which doubtless were altered capillaries), performing to a limited extent the office of returning the blood towards the cava, but utterly unfitted for transmitting blood which was to be deprived of certain substances during its passage through them, even supposing the active agents in this change,—the cells, still existed in a healthy state.

Ducts.—The ducts were injected without difficulty, and the injection in many instances reached the lobules, and ran very freely in the smaller branches in the interlobular fissures. (Plate XVI, fig. 6.) In fig. 4, some of the smaller branches of duct which had been injected are represented.

Unfortunately no trunk of artery sufficiently large to receive the pipe could be found in the portion of liver examined, so that I am unable to describe the state of these vessels.

Cells.—With regard to the cells, they were small and shrivelled; a few oil-globules were found in some places near the portal aspect of the lobules, but over a great extent of gland structure, the cells had almost entirely disappeared, their place being occupied by masses of a perfectly clear transparent material, probably of an albuminous nature. These are represented at *c*, fig. 1 and fig. 3, and are probably to be regarded as composed of material which ought to have been elaborated by the cells. Bodies in various stages between the liver cell, and these transparent structures were observed and have been copied in fig. 3.

From the appearances just described, it is clear that the lobules have wasted, and the interlobular spaces have increased in extent. The wasting has commenced at the circumference or portal aspect of the lobule, and gradually proceeded towards the central part. This being the last to disappear, as shown by the position of the interlobular veins. The capillary vessels have wasted, a very few branches only remaining pervious, which have increased in diameter to such an extent as to allow a quantity of blood sufficient to have supplied numerous capillary vessels to pass through them. With care the remains of the network which originally contained cells at the outer part of the lobule, may be traced amongst the material which occupies

the intervals between the remains of the lobules, and branches of duct can be clearly demonstrated.

ON THE CHANGES TAKING PLACE IN CIRRHOSIS.

It is my desire to postpone any general remarks upon the nature and course of the morbid changes which are described in different cases of disease of the liver, until these have accumulated to such an extent as to justify me in drawing inferences. I cannot, however, forbear transgressing the rule I have laid down in this instance, and recording the conclusions to which I have been led, with reference to the nature of cirrhosis, from a consideration of the facts observed in the present case, and less minutely in three others. The changes receive interpretation from, and in their turn confirm, my observations on the anatomy of the healthy liver, and it would, I think, be difficult to explain the facts upon any other view of the anatomy of the organ. At the same time I am anxious to avoid committing the error of attempting to generalize on insufficient data, and shall therefore confine myself, as far as possible, to remarks which are fully justified by the appearances which have been observed in this case, and which have been copied in the drawings.

From the different points which have been demonstrated, one is led to conclude that in cirrhosis the change always commences in the cells, near the portal aspect of the lobule, and gradually progresses towards the centre. The cells at the circumference of the lobule being exposed to the action of blood overcharged with deleterious substances (alcohol, or substances resulting from its decomposition) recently absorbed from the intestine, deteriorate in structure. In consequence of the altered state of the cells, they cease to exert that attractive force, which they possess in health in an eminent degree, upon the portal blood as it flows through the capillaries. The blood therefore circulates more slowly, and tends to accumulate in the organ. The branches of the portal vein become unduly distended.

This state of things may only be of temporary duration. The cells being again supplied with healthy blood may resume their normal functions; or, the causes, which first gave rise to the derangement, still continuing, will produce further and permanent alterations.

The congestion caused at first would gradually pass off, as the blood found its way back to the cava by other channels. The capillaries of the lobule no longer called upon to transmit the normal amount of blood, would deteriorate in structure, and their capacity would diminish. The small amount of blood distributed to the lobule under these altered conditions, would reach the intralobular vein by the most direct route, and the

communication would be kept up by one or two straight branches passing directly through the lobule, from the branches of the portal, to those of the hepatic vein.

The wasting of the cells and shrinking of the vessels would still proceed, and the whole organ would diminish in bulk.

The trunks of the portal vein no longer required to transmit the enormous amount of blood which they do in health, would shrink, and the other large vessels would suffer a corresponding change.

At the same time that the lobules were diminishing in size, the smaller interlobular fissures, in consequence of the shrinking of the vessels they contained, would scarcely be visible, and hence several lobules would appear to be fused together, separated here and there from other collections by intervals corresponding to portal canals, containing only vessels and ducts, but increased in diameter, by the shrinking and alteration of the lobules which formed their boundaries.

The impeded circulation through the liver would seriously interfere with the onward course of the blood from the intestines, and a condition of the intestinal capillaries very unfavourable for absorption of the constituents of the food would be induced, and this would be aggravated by the presence of bile impaired in quality and insufficient in quantity. At length the action of the alimentary canal would become more and more disturbed, the blood deteriorated, and consequently the actions of other organs more or less interfered with. The impediment to the circulation through the liver, and the state of the blood, favour the transudation of serum into the peritoneal cavity. The digestive process becoming much deranged, the whole organism would suffer in nutrition, all the nutritive functions are impaired, and the powers of the patient at length exhausted.

Such is a rough history of the changes occurring in cirrhosis, as deduced from an examination of the liver after death, and a consideration of the symptoms which manifest themselves in the course of the disease. Although these views differ materially from those generally entertained with regard to the nature of the affection, they are the only ones which I believe will be found in accordance with the morbid changes which have been demonstrated.

Let it be supposed for a moment, that lymph were actually effused into the portal canals as described, which lymph by its contraction and subsequent conversion into fibrous tissue impeded the flow of blood to the lobules, how are we to account for the numerous large and small vessels which still remain pervious in the portal canals? And why should the capillaries in the lobule

for the most part cease to transmit blood, while those in the portal canals allowed fluid to pass through them readily? The contraction of such lymph would certainly compress the ducts, and cause them to waste; but I have shown that these are demonstrable, both in injected and uninjected preparations. The so-called fibrous tissue is traversed in every part both by vessels and ducts, and in many situations the coats of these channels are in such close contact as to render the existence of this fibrous tissue absolutely impossible; and it is doubtful if the fibrous appearance certainly observed in some situations in uninjected specimens, is not due rather to the remains of wasted and shrunken vessels and ducts than to the presence of an adventitious tissue.

The *very gradual* alteration and wasting of the cells, with progressive shrinking of the lobules from the circumference towards the centre, and the degeneration in the capillaries of the lobule, evidently resulting from impaired nutrition and inaction, are not easily explained by the view, that cirrhosis depends upon impediment to the circulation in the portal vessels, caused by the contraction of inflammatory products effused into the portal canals. The persistence of pervious vessels in considerable number in the portal canals and interlobular fissures, and the existence of ducts which may be readily injected, are quite incompatible with such an explanation.

From a careful examination of the parts, then, one is led to conclude that the morbid changes in cirrhosis are not dependent upon inflammation, neither is there any evidence whatever of the presence of any tissue which by its contraction would lead to the alterations in the structure of the gland which have been demonstrated.

The first morbid change in cirrhosis affects the cells, and the subsequent alterations result from this, according to well-known physiological laws.

Such a view of the pathology of cirrhosis naturally suggests observations on the treatment of the disease, but these I must postpone until many other cases have been the subjects of observation.

It will be interesting to contrast the changes in the present case of cirrhosis with those met with in the following case.

Case II.—*Liver presenting many of the characters of Cirrhosis, resulting from obstruction of the Common Duct.*

The patient was a man, about 40 years of age, in affluent circumstances, who had been, at various times, attended by several eminent physicians and surgeons in town. He had been

suffering for two years from symptoms referable to the liver with biliary obstruction, and was jaundiced. Some time before his death ascites came on, for which he was twice tapped. He died about a fortnight after the second tapping.

An enlarged, very hard lymphatic gland was found at the junction of the cystic and hepatic ducts. This was intimately adherent to their coats, and the ducts seemed to be almost embedded in the tumour. By its gradual increase in size, the duct had been compressed to such an extent that the smallest quantity of bile only could be forced through the opening, by dint of using great force. The bile itself contained many hard solid portions (inspissated bile), far too large to pass through the opening. Above this point, and throughout the whole liver, the ducts were very much dilated. The right hepatic duct was as large as the thumb, and the interlobular ducts were always larger than the corresponding branches of the portal vein. The branches of the hepatic artery were twice the natural size, or even larger.

The liver was slightly enlarged, especially on the right side. It was very hard and pale in colour; the surface was uneven, the little elevations evidently consisting of altered lobules.

Upon making a section of this liver, appearances very similar to those met with in cirrhosis were observed, with the exception of the presence of the much enlarged ducts.

A thin section magnified six diameters, and examined by transmitted light, is represented in plate XV, fig. 1. No one can fail to observe the great similarity of this drawing to fig. 2, which has been copied from a thin section of cirrhose liver. Upon careful examination, it will be noticed that in fig. 1 there are a great number of isolated patches of hepatic tissue, evidently the remains of lobules, surrounded by a fibrous-looking material, *a*, in all respects resembling that met with in cirrhosis. At *b* some lobules are represented which are gradually disappearing. As in cirrhosis, the change commences at the circumference of the lobule, and proceeds towards the centre; but it depends upon a different cause, as will presently be shown.

Almost every individual lobule could be seen separated from its neighbours by a certain amount of the fibrous-looking tissue. Where the lobules still retained their normal size, or nearly so, they were separated from adjacent ones by a slight interval; but where little of the lobule remained, the separation was proportionllay increased, as is well seen in the neighbourhood of *b*. It was quite evident that in this case the fibrous-like material was formed at *the expense* of the lobules, and hence that,

although there was great alteration in the structure, there was little change in the quantity of tissue,—in the volume of the whole organ, or of its parts. In these wide interlobular spaces small collections of yellow colouring matter were observed here and there, marking the course of the ducts. Upon examining the spaces, with a high power, a network, the meshes of which contained a highly refracting material, was observed in many situations. That the fibrous appearance exhibited when the specimen was examined with a low power was not due to the existence of fibrous tissue was shown by the free ramification of vessels in the intervals between the lobules, as proved by injection, which was readily forced into branches of the vein, artery, and duct. Plate XVII, figs. 3, 2, 1.

As much of the secreting structure of the lobule as remained, appeared healthy. The capillaries were of their normal size, and were readily and completely injected. The capillaries injected from the portal vein are represented in plate XVII, fig. 3, magnified 15 diameters, and in fig. 6 injected from the hepatic vein, magnified 42 diameters.

Artery.—The branches of the artery were very numerous, and the trunks considerably larger than in health, as we should expect would be the case from the great increase in dimensions of the duct. The artery is shown in plate XVII, fig. 2.

Duct.—The duct was injected in one part of the liver, and injection was readily forced into numerous vessels occupying the intervals between the lobules. Plate XVII, fig. 1.

Cell-containing Network.—In many parts of the liver the connection between the ducts and the network of the lobule was very distinct. Fig. 4 is taken from the narrowest part of an interlobular fissure. The tubes of the network do not contain cells, but are occupied with granular matter and oil-globules only. The network in the upper part of the figure doubtless belonged to the lobule, but now forms part of a wide interlobular space. In fig. 5 a corresponding portion of the network, which had been injected, and was taken from another specimen, is represented. The cells were much shrunken, and the tubes of the network appeared for the most part to be occupied with a material possessing the same refractive power and general appearance as the cells, but having but few indications of division into separate particles.

These changes are to be accounted for by the partial and gradually increasing obstruction situated at the commencement of the common duct. The dilatation of the ducts in the portal canals and interlobular fissures would gradually extend backwards, and soon the secreting tubes at the edges of the lobules

would be affected by the pressure. The alteration thus occasioned would gradually increase; the process of secretion being interfered with in the most external cells, these would waste, and the secreting structure of the lobule would gradually recede. In consequence the lobules would become very much reduced in dimensions. The tubes of the network at the edges of the lobule would gradually lose their cells, and would contain only debris and transparent bile. The capillaries in the same situation, partly from pressure, and partly from the usual supply of blood not being required, as the cells have disappeared, would shrink. In consequence of these changes the lobules at their circumference become transparent, and much of what was once lobule, because it contained secreting cells, would now be included in the "interlobular space," or "fissure."

That this was really the explanation of the wide interlobular spaces was proved by careful examination with a high power, when the tubes of the network could be seen, fig. 4, and by injection, when they were very readily distended, fig. 5.

In comparing the changes which had taken place in these two livers, it is interesting to notice the following points:

1. The cirrhose liver was smaller than the healthy organ. The obstructed liver slightly larger.

2. In the first, the diminution of size of the lobules was associated with loss of tissue of the whole organ. In the second, although the lobules were very small, the whole organ was even a little larger than natural.

3. In the cirrhose liver the structure of the lobule was completely disorganized, and in part absorbed. In the obstructed liver, as the lobules diminished in size, the interlobular spaces increased in diameter. What the lobule lost the space gained. In the first, there is an absolute wasting—a loss of material. In the second, there is a change in the character of the tissue, without alteration in the bulk of the organ.

4. The capillaries of the cirrhose lobule were shrivelled and wasted, so as not to permit the passage of blood through them, while the circulation in the capillaries of the obstructed lobule was quite free.

5. The secreting structure of the cirrhose liver has wasted, in consequence of receiving an improper pabulum, but the immediate cause of the changes in the obstructed liver was a physical impediment to the escape of the secretion of the gland.

6. In this case of obstruction it would seem that the organ was prevented from performing its functions to the proper extent. In cirrhosis the liver undergoes a gradual process of decay.

RESULTS OF CHEMICAL AND MICROSCOPICAL EXAMINATIONS OF SOLID ORGANS AND SECRETIONS, &c.

CANCER DIFFUSED THROUGH THE ENTIRE LIVER.

EXAMINED BY THE EDITOR.

IN this case, if we are permitted to draw an inference from the symptoms, the morbid changes in the liver would appear to have taken place very rapidly, for the first symptom of uneasiness experienced by the man occurred only four or five months before his death; this is remarkable, when the extensive alteration in the structure of the gland is taken into consideration. Such affections, however, as is well known, sometimes come on so insidiously, and progress so gradually, that great alteration may occur in the gland structure, and the functions of the organ may be irretrievably impaired, before the patient's attention has been attracted to the seat of disease. The malady may, therefore, appear to have run a much more rapid course than is really the case.

For the opportunity of examining this liver I am indebted to Dr. Todd, to whom the specimen was sent by Mr. Robert Ceely, of Aylesbury, who furnished the following history of the case:—

"Thomas Inns, æt. 59 years, admitted into the Bucks Infirmary, September 9th, 1857, complexion dark, icteroid; by trade a painter. Some years ago drank two, three, and sometimes four glasses of gin daily, besides beer. Recently was more temperate, and states his drink consisted of beer only.

"About 14 weeks prior to admission, for the first time, applied to his medical man, as he was suffering from pain in his back and abdomen, and from constipation.

"Upon admission, the abdomen was found dull upon percussion, as low down upon right side as the umbilicus, and in this region, was hard and tender upon pressure; left hypochondriac region extremely tender upon pressure; the outline of the liver could not be determined with accuracy, owing to the quantity of fluid in the abdomen; legs slightly œdematous.

"Urine contains urate of ammonia, but no albumen; alvine evacuations dark brown, and variegated with numerous yellow points.

"24th.—℞ Ext. elaterii, gr. j; pil. coloc. co.; pil. gambog. co. ā ʒss. Ut ft. pil vj; ij alt. m.

"The first dose produced six fluid evacuations.

"The pain in the back became aggravated, and he now suffered much from exhaustion. To have 3 oz. of gin daily, with beef-tea, and a pill containing one-third of a grain of morphia at night.

"The œdema of legs increased enormously; they also became red and glazed. Ordered, ten minims of tincture of sesq.-chloride of iron, and half a drachm of spirits of nitric ether, three times a day.

"Oct. 19th.—Throat apthous, and so sore as to prevent him swallowing other than liquid nutriment. The apthous state of fauces increased, the mouth and tongue also became affected in a similar manner; he lost his voice, and gradually sunk until the 24th October, 1857, retaining his consciousness till the last moment.

"*Post mortem.*—Nearly the whole mass of the liver was converted into a soft whitish cancerous mass, weighing nearly double the natural weight. It was much enlarged. Gall-bladder distended, with dark yellow bile; there was, also, a mass of glands similarly diseased, surrounding the aorta and vena cava. No other disease observed in the abdomen, which contained several pints of yellowish serous fluid. The legs and thighs were highly œdematous. The body much emaciated."

The appearance of a freshly cut surface of the liver is represented in plate XVIII, fig. 1; nothing resembling the ordinary appearance of the healthy liver is to be seen. Spaces, varying much in size, of irregular form, and perfectly white, are observed everywhere; these are separated by intervals resembling interlobular fissures. When a thin section is made and held up to the light, the white spaces appear dark, from the opacity of the structure of which they are composed, as represented in the plate, while the fissures which separate them are transparent, and have a fibrous appearance, owing to the greater transparency of the tissue in this situation.

The characters of a section, magnified six diameters, are represented in fig. 2. Some of the spaces, from which the white pulpy material has been partly removed by washing, are seen to be intersected in various directions by lines, as represented at *a*; the spaces between these lines are entirely occupied by the white pulp.

I will now describe the structure of these parts, as observed by microscopical examination, alluding to

1. The spaces filled with white pulpy matter, and
2. The more transparent fibrous-like partitions which intervene between them.

Of the Spaces filled with White Pulpy Matter.

The pulpy matter consists entirely of cells with fragments of tissue, which intersect the spaces in every direction. The cells vary much in size and form; many contain several nuclei. Their microscopical characters accord generally with those of soft cancer of the liver, *c*, *d*, *h*, fig. 14.

A part of the space represented at *a*, fig. 2, plate XVIII, is shown in fig. 4, magnified 42 diameters. The lines before alluded to are seen to consist of tubes, two or three of which are still more highly magnified in the drawing, represented at fig. 3. These tubes, for the most part, communicate freely with each other, but their cavity is almost entirely occupied by small granular cells, granular matter, and oil-globules. They vary very much in diameter; and from their arrangement, one is led to conclude that they have been much stretched. The cancer cells in most instances seem to be separated from these tubes by a slight interval, but here and there a few cells appeared as if they were connected with the tube. In some situations the tubes seemed to have been distended with these cells, and to have burst and set them free. The cells probably had still continued to grow and multiply, gradually encroaching on the healthy structure until no traces of it remained. Some of the cells, magnified 215 diameters, are represented at *d* and *h* in the wood-cut, fig. 14. It seems probable that after being developed in the tubes above described the cells had been set free, and still increasing in numbers and size had gradually filled the spaces before alluded to. (Plate XVIII, fig. 2.) If this supposition be correct, they would gradually encroach upon the tubes in which they were developed, and these, would in their turn disappear, leaving the cavities entirely occupied by cancer cells, as was observed in the majority of the opaque spots. This development of cells still continuing, the structures intervening would be gradually compressed by the accumulation, and the original healthy tissue would be destroyed by the encroachment of the rapidly growing cell structure. The cancerous masses were softest in the centre, and here in many cases, disintegration was commencing; this being that portion of the growth which was first formed.

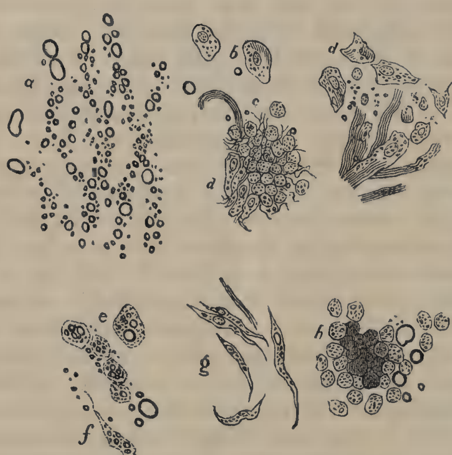
I shall not at present venture to express a positive opinion upon the nature of the tubes, which were clearly the seat of original development of the cancerous matter. They may be altered capillaries or lympathic vessels, or they may be entirely

new structures. From various circumstances, however, I incline to the belief that they are altered venous capillaries.

Of the Transparent Fibrous-like Partitions between the Soft White Masses.

These were in many places penetrated by vessels which would freely transmit fluid, and which were injected in one part of the specimen. Here and there a striated appearance was observable, and when these parts were examined with a power of 130 diameters, the striæ were found to be caused by the presence of oil-globules, arranged after the manner of a network, as represented at *a* in the wood-cut (fig. 14). There can be no doubt that this was the remains of the secreting structure of the lobule. In some situations, where the disease had not progressed to so great an extent, liver cells, more or less altered by stretching, pressure, and an insufficient supply of nutrient material, were found, as shown at *e* and *f*. At *b*, two liver cells from the interval between two collections of cancerous matter

FIG. 14.



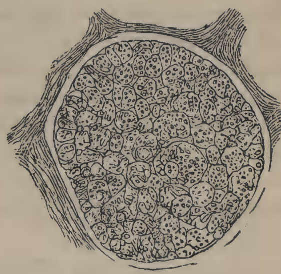
Drawings taken from the collections of cancerous matter and from the intervals between them. *a*. Remains of the secreting structure of the lobules. *b*. Liver cells from the interval between two collections; *c*, *d*, also from the surface of one of the cancerous masses, shewing delicate fibrous tissue, cells, and fibre-cells. *e*. Remains of secreting cells in the interval between the cancerous collections. *g*. Fibre-cells from the surface of a collection. *h*. Cells from a short distance within one of the tumors. × 215.

are represented: *d* represents the different forms of cells, fibre-cells, and delicate fibres met with on the surface of the collections (these structures are in all probability of recent origin): *g* represents some well-developed fibre-cells from the

same locality: while *h* shows the appearance of the cells at a short distance within the tumors.

It is exceedingly difficult to deduce from the facts observed in this specimen, a history of the morbid changes from their commencement. The case differs in many respects from ordinary cases of cancer of the liver. Usually, as is well-known, the cancerous tumors are quite circumscribed and scattered at intervals through the organ. A few often attain a very large size, leaving however between them plenty of healthy secreting structure. In these cases I believe the tumors always commence in the portal canals and gradually increase in size, stretching the surrounding tissue, but separated from it by a distinct line of demarcation. From a well-marked case of this kind I obtained the specimen from which fig. 15 was copied. This is the smallest tumor of the kind I have ever met with, being only 1-200th of an inch in diameter. It was situated in a small portal canal, was surrounded with vessels, and invested with a delicate fibrous capsule. Already it contained a considerable number of cells. The largest, with its nucleus having several nucleoli, is observed a little below, and to the right of the centre of the tumor. This is probably the oldest cell of the collection.

FIG. 15.



1000ths |___|___|___|___| × 215

Small cancerous tumor from a portal canal, containing a number of cells. × 215 diameters. From a woman, aged 51, who died of cancer of the liver, in King's College Hospital.—M.B., 572.

In the present case, however, the whole organ was diseased. Every part seemed to be the seat of cancerous collections. These masses by their growth must have compressed the tissue of the gland between them, and caused its gradual deterioration and ultimate removal. From the fact that these were diffused equally through the liver, while they varied very little in size, we may conclude that they commenced growing at about the same period of time. The germs must therefore have been diffused through the structure of the organ generally; but whether the development of these commenced in venous capillaries, lymphatic vessels, or external to them, it is impossible to say. Various circumstances, however, favour the idea that either the venous capillaries or the lymphatics were the original seat of development of the structure, and I incline to the belief that in the present instance, the former was their seat of origin.

CURIOUS FORM OF URIC ACID CRYSTALS.

THESE crystals were for the most part semicircular and wedge-shaped; some were nearly circular, sharp at the edges, the centre being the thickest part. They were deposited, after the lapse of some days, in the urine of a man in pretty good health, but suffering at the time from slight indigestion. The urine was pale and acid, it contained no albumen or sugar; a few fungi were found upon the surface of the urine, and the deposit contained crystals of oxalate of lime. After standing for some days, the number of fungi much increased, and gradually crystals of uric acid made their appearance. These increased in number and size for some days afterwards. The characters of the deposit are represented in fig. 3, plate XIX. A more minute description is therefore unnecessary.

URINE CONTAINING CYSTINE.

SENT BY DR. MILNER BARRY.

WITH ANALYSES.

BUT little is known of the causes of the formation of cystine. Its presence is associated with a very depressed condition of the vital powers, and no doubt at least one circumstance favourable to its formation is insufficient oxidation. Cystine, as is well known, contains upwards of 25 per cent. of sulphur, derived doubtless from the disintegration of albuminous tissues. In health, when the oxidizing processes are actively carried on, the greater part of the sulphur passes off in the urine, in the form of sulphuric acid; but in low conditions of the system some of this sulphur passes off, in combination with extractives, or as cystine, either in an amorphous form or beautifully crystallised in six-sided plates.*

If an amorphous sediment, which consists of cystine, be dissolved in ammonia, and the solution allowed to evaporate spontaneously, crystals will be formed.

Dr. Golding Bird draws attention to the hereditary character of this urinary deposit, and mentions one instance in which it was traced through three generations.

Dr. Shearman has brought forward several cases occurring in chlorotic girls. Some time since, while examining

* Illustrations of the Constituents of Urine, Urinary Deposits, and Calculi, plate X.

for Dr. Sutherland the urine of numerous cases of insanity,* I was surprised at the great number of specimens which, after standing a few days, evolved large quantities of sulphuretted hydrogen, a change which is rarely met with in the urine of cases admitted to our hospitals. In these cases, therefore, a considerable amount of sulphur must have been excreted in an unoxidized state.

Dr. Johnson met with large quantities of cystine in the urine of a man who had been for some time in prison, and was weak, emaciated, and out of health.

The present specimen of urine containing cystine, was passed by a gentleman 23 years of age; and for the following notes of his case, I am indebted to Dr. Milner Barry, of Tunbridge Wells:—

"Mr. A., age 23, dark complexion, well built and well nourished, of active habits, assiduously engaged in the duties of a laborious profession, suffers occasionally from sick headache, but is otherwise in the enjoyment of excellent health. The presence of cystine was ascertained microscopically at the beginning of October 1857, but, as deposits supposed to be urates had often been previously noticed, the probability is that the cystine had been excreted in the urine for a long time. It seems now never to be absent from the urine; debilitating agencies, and whatever promotes the metamorphosis of tissue, intellectual exertion, active bodily exercise, mental anxiety, and smoking, appear to cause an increase in the amount of cystine. You will observe the much larger relative proportion of the ingredient in the morning urine than in that passed in the evening, a few hours after a meal. There is no lumbar pain, and no irritability of the bladder."

The first specimen of urine was received in October, 1857. It was of the natural colour, of acid reaction, and had a smell not unlike that of sweet-briar. Specific gravity, 1028.

Analysis 9.			In 100 grs. of solid matter.
	Water	937·60	
	Solid matter	62·40	
	Urea	32·80	51·28
	Uric acid	·50	·80
	Extractive matter	12·90	20·67
Fixed Salts 16·00	Sulphuric acid	1·70	2·72
	Chloride of sodium	12·00	19·23
	Earthy phosphates	1·00	1·602
	Alkaline phosphates	2·50	4·00

* Trans. Med. Chir. Soc., vol. xxxviii, 1855, p. 26.

The next specimens were received on January 28th, 1858.

No. 10 was passed on the morning of the 27th, at 8 o'clock (before breakfast). Its specific gravity was 1034.

Analysis 10.

			In 100 grs. of solid matter.
	Water	916·00	
	Solid matter	84·00	
	Cystine	·906	1·08
	Urea	49·00	58·33
	Extractives	16·94	19·52
Fixed Salts 17·6*	Chloride of sodium	9·30	11·07
	Sulphuric acid	4·50	5·35
	Earthy phosphates	·60	·71
	Alkaline phosphates	4·20	5·00

No. 11 was passed at 9 p.m., on the 26th, three hours after dinner. Specific gravity, 1027.

Analysis 11.

			In 100 grs. of solid matter.
	Water	949·30	
	Solid matter	50·70	
	Cystine	Too little to estimate	
	Urea	28·40	56·01
	Extractives	1·30	2·76
Fixed Salts 19·6	Chloride of sodium	11·20	22·09
	Sulphuric acid	1·90	3·74
	Earthy phosphates	·60	1·18
	Alkaline phosphates	2·30	4·53

In these analyses it is interesting to notice that the sulphuric acid is by no means deficient; indeed, in the second, the amount present is considerably above the average quantity met with in healthy urine. The proportion of cystine present, although occupying a considerable bulk, is really very small, so that the opinion commonly entertained with reference to cystine being a compound in which the sulphur is removed from the organism in an unoxidized state, in consequence of the oxidizing processes of the organism being in a low state, will not explain its formation in the present case, as the analyses prove that a much larger quantity of sulphur passed off as sulphuric acid than in a state of combination in the form of cystine.

* In these analyses the fixed salts were estimated by incineration, while the sulphuric acid, phosphoric acid, and chloride of sodium were estimated volumetrically. The slight discrepancy in the numbers arises partly from the volatilization of some of the saline constituents during incineration, and partly from slight errors in the analyses, unavoidable when only small quantities are operated on.

LIQUOR AMNII, CONTAINING MUCH UREA.

THIS specimen was removed from a lady, aged 38, in her second pregnancy. She was under the care of Dr. Robert Lee, Dr. Todd, and Mr. Tayloe, of Clapham. The patient was in the eighth month of pregnancy, and about seven pints of fluid were drawn off.

The specific gravity of the fluid was 1006. The deposit was flocculent, and consisted principally of epithelial cells and oil globules from the surface of the skin of the fœtus. A few circular cells, probably derived from the bladder, and some particles of dark green and brown colouring matter (meconium) were also present. (Plate XIX, fig. 214).

Urea.—A portion of the fluid was evaporated to dryness, and extracted with alcohol. The alcoholic solution was concentrated by evaporation, and treated with a drop of nitric acid. A number of crystals of nitrate of urea were formed. In another quantity, the urea was estimated, and the following results obtained:

Analysis 12.

Water	987·00
Solid matter	13·00
Urea	3·50
Albumen and salts	9·50

2. In a specimen which was sent to me some years ago, by Dr. Farre, and obtained from a woman at about the same period of pregnancy, I found a number of casts of the uriniferous tubes. Many were granular, and they presented the ordinary characters of casts, but were scarcely half the diameter of those found in the adult. A drawing was made at the time, but has unfortunately been mislaid.

Its reaction was acid, and remained so for some days after it had been obtained.

The specific gravity of this specimen was 1009·2. It contained in 1000 parts:

Analysis 13.		In 100 parts of solid matter.
Water	982·00	
Solid matter	18·00	
Organic matter soluble in water ...	6·11	33·94
Fixed alkaline salts	8·09	44·94
Albumen, earthy salts, and fatty matter	3·80	21·11

This specimen was not tested for urea; but the presence of casts proves that it contained substances derived from the kidney.

Most conflicting statements have been made in reference to the question of the presence of urinary constituents in the liquor amnii. Some authorities hold that the urine of the fœtus becomes mixed with this fluid, while others assert that this is not the case. We know that in the earlier months of pregnancy the liquor amnii is much richer in albumen than in the later months; and although this fluid doubtless supplies nutrient material to the embryo at an early period, it is probable that when developed it is not dependent upon the fluid which surrounds it for nutrition. It is not unreasonable to suppose that during the later months, when the greater part of the albumen had been absorbed and appropriated, and it was no longer required as a nutrient material, that the urine of the fœtus should become mixed with it. There would be no danger of the reabsorption of the urinary constituents by the fœtus, as it is covered with a thick layer of the vernix caseosa, which contains much oily matter. Many specimens of liquor amnii have been examined by chemists, in order to ascertain if the ordinary constituents of urine, especially urea, were present, but opposite conclusions have been arrived at. Dr. Mack and Voigt failed to detect urea, while it was found in one specimen examined by Colberg, but not in another. Dr. Rees has detected it in four specimens. Of its existence in the present case there cannot be the least doubt, as the crystals were subjected to microscopical examination, and there are no crystals formed under the circumstances that these were developed, which can possibly be mistaken for nitrate of urea. The discrepancy on this point probably arises from the circumstance that many specimens were not examined, until decomposition of any urea present, had occurred. That urine is secreted by the kidneys, at least as early as the eighth month of intrauterine life, was proved beyond a doubt many years since by Dr. Robert Lee, in a case in which the secretion from these organs had accumulated in the obstructed ureters. Uric acid and urea were detected in the fluid by Dr. Prout.*

The presence of casts of the uriniferous tubes in one, and the existence of a considerable quantity of urea in the second of the two perfectly fresh specimens of liquor amnii unmixed with blood, that I have examined, leave no doubt in my own mind that the urine of the fœtus in the later months of pregnancy escapes into the amnion, and becomes mixed with the liquor amnii. These facts confirm the conclusions previously arrived at by Dr. G. O. Rees and others.

* "On the Functions of the Fœtal Kidney," by Robert Lee, M.D., F.R.S., Med. Chir. Trans., vol. xix, 1835.

CASE OF RAPE, WITH MICROSCOPIC EXAMINATION OF THE LINEN.

By Henry Munroe, M.D.,
Lecturer on Forensic Medicine and Histology at the Hull School of Medicine.

ALTHOUGH the detection of spermatozoa on linen would not in a court of law alone establish the fact of a rape having been committed, but only the minor offence of an indecent assault, yet, when accompanied with other signs of injuries to the generative organs, observed by the medical man in immediate attendance upon the case, it would strengthen very much the supposition that rape had been committed. The detection of spermatozoa in the vagina, at a point beyond the hymen, would alone, as microscopic evidence, tend to prove that that crime had been perpetrated.

In August last I received for examination from a medical practitioner, not a microscopist, a chemise of a young girl about fourteen years of age, upon whom, three days before, it was alleged a rape had been committed. The chemise, a linen one, appeared to have been worn some days, and was very much stained with the menstrual discharge; there were also conspicuously seen spots of pure blood, and other stains presenting the characters of semen.

The reasons for my believing the majority of the stains on the chemise to be of a menstrual character were, that it was less deeply and uniformly stained than by blood; the stain was also of a lighter tinge than blood, and bounded at the circumference by a deeper colour. The stains were of a darker colour than arterial blood, and did not change colour by exposure to the air, as does venous blood. There were also many spots of pure blood, presenting a deep colour throughout, as well at the circumference as in the centre.

There were found also several greyish stains, causing the linen to feel stiff, as if starched. On exposing one or two of these stains to the action of heat they assumed that peculiar light fawn-colour characteristic of the effect of heat on seminal stains, which change does not take place with any other healthy or morbid discharge.

The microscopical investigation was as follows: on cutting out some of the greyish and coloured stains, macerating them in distilled water for some time, and afterwards concentrating very much the solution, and placing the same under one of Ross's best quarter-inch object glasses, with an angle of aperture of 130°, and a magnifying power of about 215 diameters with the lowest eyepiece, numerous whole spermatozoa were seen, and also many others much mutilated,—here only a head and there only a tail,—indisputably proving the stain to be

seminal. There were also many blood globules and epithelial scales from the vagina and neck of the uterus, the latter proving the stain to be of a menstrual character. There were seen, also, what I took to be mucous globules, and here and there fibres of linen. I have drawn, by the camera lucida, a figure of the microscopical appearances of these stains, in accordance with the rules laid down in Dr. Beale's work "The use of the Microscope in Clinical Medicine," which will in some measure assist the reader. (Plate XIX, fig. 1).

Had the medical man in immediate attendance on the case been a microscopist, and obtained some of the mucus from the vagina, the proof of rape having been perpetrated would have been more satisfactory to the investigator, and shown the value of the microscope as a means of detection in such cases.

With this investigation I had no hesitation in pronouncing the stains to be of a seminal character, mixed with blood and menstrual discharge. The prisoner at this portion of the trial pleaded guilty to the charge of rape.

FUNGI REMOVED FROM THE EAR.

THE vegetable growth represented in fig. 16 was removed by Mr. Grove from the external meatus of a gentleman in good health, who had been suffering from inflammation of the canal. The specimen was given by Mr. Deane to Dr. Sturt, who kindly allowed me to have the accompanying drawing of it made.*

Fig. 16.

Fungi from the external ear. Aspergillus? ×215.

A case in which a fungus of the same kind in all probability, was found in the external meatus of a girl, aged 8, is given by Mayer. She was a scrofulous child, suffering from discharge from the ear. Many filaments contained a receptacle filled with spores.†

Link considers this fungus to be a species of Aspergillus, and Robin places it in the same genus.‡

* The case, accompanied with a drawing, is given in the Trans. of the Microscopical Soc., New Series, vol. v, p. 161.

† Müller's Archiv. 1844, p. 404.

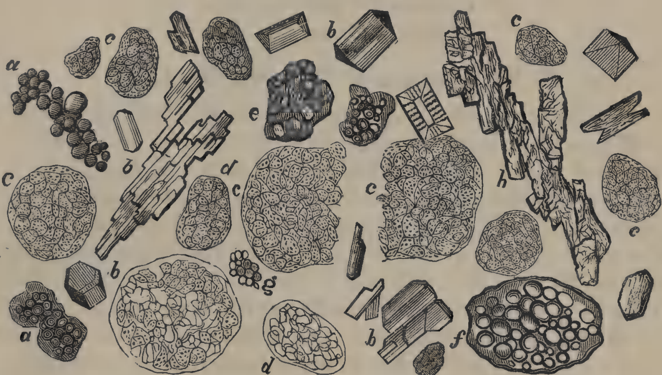
‡ Histoire Naturelle des Végétaux Parasites, par Ch. Robin. 1853.

SUBSTANCES PASSED FROM THE BOWEL.

SENT BY MR. R. E. THOMPSON.

THE deposit represented in fig. 17 was obtained from the stools of a girl admitted into Addenbrooke's Hospital, Cambridge; she was 18 years of age, single, pale, and suffering from a hard frequent cough, with fever. The catamenia had never

FIG. 17.



a. Rounded masses of earthy matter, probably carbonate and phosphate of lime. *b.* Crystals of triple or ammoniaco-magnesian phosphate. *c.* Oval masses, probably fragments of a clot. In one, to the left of the figure, the outline of the blood corpuscles is more distinct than in most, and in *d* the individual corpuscles can be seen. *e.* Dark amorphous masses, probably derived from the food. *f.* Ovum of an entozoon, probably an ascaris. *g.* Small collection of blood corpuscles.

appeared. Below the scapula there was crepitation, also dulness under the right clavicle, with bronchophony. She soon improved in health. The material passed from the bowel was of a very dark color, perfectly fluid, and yielded a precipitate on the application of heat, and upon adding nitric acid. Upon examining the deposit with a power of 215 diameters, a number of oval granular masses, of a pale brown color were discovered; these had smooth, rounded edges, as if they had been partly dissolved, and some contained a number of circular bodies, with a very thin outline, which were probably altered blood corpuscles. It is probable that the bodies above described were fragments of a clot of blood which had been broken up, and the portions, in consequence of being acted upon by the juices of the intestine, had become smooth and transparent. The various substances found in the deposit are referred to in the explanation of the woodcut.—[EDITOR.]

PROCESSES OF PRACTICAL VALUE IN CARRYING OUT SCIENTIFIC ENQUIRIES BEARING UPON MEDICINE.

ON THE ESTIMATION OF UREA, CHLORIDES, SULPHATES, PHOSPHATES, AND SUGAR IN URINE VOLUMETRICALLY.

By Moritz von Bose, Ph. D.,
Assistant in Dr. Beale's Laboratory.

(*Concluded from page* 42.)

5. Estimation of Phosphoric Acid.

THE estimation of phosphoric acid is effected by a solution of perchloride of iron, after the fluid to be tested has first been mixed with a solution of acetate of soda and free acetic acid.

If perchloride of iron be added to a solution containing phosphoric acid, a precipitate of phosphate of iron is produced, at the same time hydrochloric acid is set free from the perchloride, and this would redissolve the phosphate. In order to prevent this, acetate of soda is added in the first instance, the free hydrochloric acid decomposes the acetate of soda, and acetic acid is set free, in which the phosphate of iron is insoluble.

Preparation of the Solutions.—1. *Solution of Perchloride of Iron*—15·556 gr. = 240·24 grs. of pure iron-wire are dissolved in pure hydrochloric acid, to which a little nitric acid has been added. The solution is evaporated to dryness on a water-bath, and the residue dissolved in water and diluted to 1000 C.C. = 15444 grs. Or a solution of perchloride of iron of moderate strength is prepared. The iron is estimated as peroxide by adding ammonia, and the solution is diluted so as to contain 1·556 grs. = 24·024 grs. of iron in 100 C.C. = 1544·4 grs. In preparing this solution care mnst be taken to avoid an excess of hydrochloric acid. One C.C. of this solution indicates ·01 gr. = ·154 grs. of phosphoric acid.

2. *Solution of Acetate of Soda and Acetic Acid.*—20 grs. = 308·88 grs. of crystallized acetate of soda are dissolved in 100 C.C. = 1544·4 grs. of water, and mixed with 100 C.C. = 1544·4 grs. of acetic acid.

3. *Solution of Ferrocyanide of Potassium.*—1 gr. = 15·44 grs. of ferrocyanide of potassium are dissolved in 100 C.C. = 1544·4 grs. of water.

Performance of the Analysis.—100 C.C. = 1544·4 grs. of the urine are mixed with 10 C.C. = 154·44 grs. of the solution of acetate of soda. The whole is divided into five parts,—*a*, *b*, *c*,

d, e—with a pipette, each part containing 20 C.C. = 308·88 grs. of urine. The burette is filled with the iron solution, and into each of the parts half a C.C. more of the solution is dropped, beginning with six half C.C., so that

a, b, c, d, e, contain
6 7 8 9 10 half C.C.

of the iron-solution. They are left for 5 — 10 minutes, then 3 C.C. = 46·3 grs. of each are filtered into 5 test-tubes kept ready; and to the filtrates 1 C.C. = 15·4 grs. of the solution of ferrocyanide of potassium is added. If in any of them the deep blue colour of Prussian blue appears, the analysis is finished, and the results may be confirmed by a second experiment. If the colour does not appear, 5 half C.C. more must be added to each of the parts, so that

a, b, c, d, e, now contain
11 12 13 14 15 half C.C.;

and after standing again the same test is applied. So one has to go on till the deep blue colour is obtained. The confirmatory analysis is better made by taking 50 C.C. = 772·2 grs. of urine in each of five beakers, mixing each of them with 5 C.C. = 77·22 grs. of the acetate-solution, and adding the proportional numbers of half C.C., that are near those indicated by the first experiment. If, for instance, the colour appeared at 12 half C.C., there must be added 28, 29, 30, 31, 32 half C.C., to the different portions of the urine.

Estimation of the Earthy Phosphates (*Phosphate of Lime and Magnesia*).—The quantity of phosphoric acid combined with earths (earthy phosphates) may be determined as follows:—First, in one portion of the urine the whole amount of phosphoric acid is estimated as above, in another portion the earthy phosphates are precipitated by a little ammonia, and the phosphoric acid in combination with alkalies in the filtered fluid is volumetrically determined. The difference between both analyses indicates the quantity of phosphoric acid combined with the earths.

If the urine to be tested is alkaline, and contains a deposit of earthy phosphates, the latter must first be dissolved by as little hydrochloric acid as possible.

To become acquainted with the colour that indicates the end of the experiments, one should the first times, besides, make an analysis of the same urine in the common way.

The volumetric method will be found described at greater length in "Gorup Besanez, Zoo-chemiche Analyse," and "Neubauer und Vogel, Analyse des Harns."

NOTE ON THE DETERMINATION OF UREA BY DAVY'S AND LIEBIG'S METHOD.

By C. Handfield Jones, M.D., F.R.S.
Senior Assistant-Physician to St. Mary's Hospital.

I HAVE had for some time an inclination towards Davy's mode of determining urea, because the preparation of the solutions for Liebig's method is not very easy or convenient, and, as I have found, one cannot always depend on their being correct when purchased.* Further, there seemed to be various corrections necessary for accurate results, viz., those mentioned by Neubauer and Vogel and Kletzinsky, which make the process far from short and easy. According to Davy's statements there does not seem to be any need for corrections, except perhaps where a large amount of uric acid is present. I do not find the original mode Davy used so trustworthy as I could wish. The employment of mercury, as Dr. Thudichum proposes, is troublesome, and in neither case is it easy to add an additional quantity of solution of chloride of soda to make

* Dr. Davy's plan is carried out as follows. A long stout glass tube is closed at one end, and ground perfectly smooth at the open extremity, capable of holding two and a-half cubic inches, and graduated to tenths and hundredths of a cubic inch, is to be filled more than a third full of mercury, and afterwards a measured quantity (from a quarter of a drachm to a drachm) of the urine poured in. Next the tube is exactly filled with a solution of chlorinated soda (hypochlorite of soda, sodæ chlorinatæ liquor, of the Dublin Pharmacopeia). Care must be taken to avoid adding too much of the solution, which must be poured in quickly. The orifice of the tube is instantly covered with the thumb, inverted once or twice, to mix the urine and hypochlorite, and placed beneath a saturated solution of salt and water contained in a cup. The mercury flows out and the solutlon of salt takes its place, but being more dense than the mixture of urine and hypochlorite, the latter always remains in the upper part of the tube. The urine is soon decomposed, bubbles of nitrogen escape, and collect in the upper part of the tube. When decomposition is complete, which is known by no more bubbles of gas being evolved, the volume collected is read off, and corrected for temperature and pressure.

$\frac{1}{5}$ grain of urea should furnish by calculation ·3098 parts of a cubic inch of nitrogen at 60° F. and 30′ Bar. In one experiment Dr. Davy obtained from the same quantity ·3001, in another ·3069.

Amount of Urea in an Ounce of Urine, as estimated by Dr. Davy, according to Liebig's Method and his own.

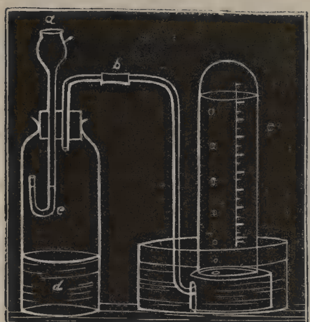
	Liebig's.	Dr. Davy's.
First experiment	3·680	3·712
Second experiment	5·328	5·472
Third experiment	4·976	4·976

—Dublin Hospital Gazette, vol. i, p. 134. 1855; also given in Braithwaite's Retrospect, vol. xxx, p. 109. 1854.

Full directions for carrying out Liebig's method of determining urea will be found in Dr. von Bose's paper; Archives of Medicine, p. 34, No. I.

sure of all the urea being decomposed;* moreover, one can scarcely operate on more than ʒss. of urine, so that errors are greatly multiplied. Lately I have used a bottle, of about 6 oz. capacity, with a curved tube of supply, and another to conduct away the gas into a graduated jar (fig. 18). I put into the bottle ʒij of urine or more, adjust the outleading tube to the jar, and pour in, with a pipette, a known bulk of solution of chloride of soda. This drives over, of course, a corresponding amount of air, and the gas generated, a further amount, so that in the jar I have an amount which — the volume of decomposing fluid = the gas generated. I have ascertained by trial that no alteration of volume takes place when air and nitrogen are mixed. The fluid remaining in the curved supply tube, bars all escape of gas, and it is perfectly easy to empty the bottle afterwards by simply inverting it, when the contents pour out of the gas-escape tube. By shaking the bottle frequently I can get an experiment finished in about an hour.

FIG. 18.



a Supply tube. *b.* Out leading tube. *c.* Fluid remaining in curve of supply tube. *d.* Mixture in bottle. *e.* Receiver to hold and measure the gas generated. After the urine is poured in, the supply tube is washed out with a little water. Of course, at any time, more solution of chlorinated soda (measured quantity) can be added through the supply tube.

In six trials (some of them being made with a straight tube of supply going to the bottom of the jar instead of a curved one), I obtained the following results:—

			Observed.			Calculated.		
(*a*)	2	grains of urea gave	3·305	C. in.	instead of	3·098	C. in.	or ·207 +
(*b*)	2	„ „	3·0979	„	„	3·098		or ·0001 –
(*c*)	1·5	„ „	2·3107	„	„	2·323		or ·0123 –
(*d*)	1·3	„ „	2·1313	„	„	2·0137		or ·1276 +
(*e*)	2·5	„ „	3·8498	„	„	3·8725		or ·0227 –
(*f*)	2	„ „	3·0256	„	„	3·098		or ·0724 –

These are not exact enough to satisfy me, but I do not see any source of fallacy in the mode, and, if in more skilful hands it should prove trustworthy, I think it would have much to recommend it on the score of facility in previous preparation. The figures have been corrected for temperature and pressure.

* The solution of chloride of soda used by Dr. Davy is the Sol. Sod. Chlor. of the Dublin Pharmacopeia. I find that it is not every specimen that serves the purpose well; what I have used lately has been made for me by Mr. Button, Holborn Bars. A fresh solution (filtered) of chloride of lime acts very energetically and quickly, much more so than the Sol. Sod. Chlor., but some carbonic acid is generated and passes over, which complicates the process.

I am tempted to mention some difficulties I have found in using Liebig's test, which have also been experienced by others. I find that taking a solution of pernitrate of mercury (which was prepared for me by Schaebt of Houndsditch, a chemist employed for the purpose by Dr. Parkes and others) I get a different indication almost every time I test it with a known weight of urea. Thus it is labelled that 1 C.C. corresponds to ·154 grain of urea, but in one trial I found 1 C.C. = ·1083 grain, in another = ·111 grain, in a third = ·125 grain, in a fourth = ·136, in a fifth = ·111 grain. So I am quite at a loss to know what figure to take as the right. I suppose it was my own unskilfulness that caused this discrepancy, but Mr. Ackland tells me that in some very careful trials he made, it was just the same, and that he does not believe a solution can be kept at the same standard, as it will undergo change. If true, this is very material; but one can scarcely suppose that so many high authorities should not have found it to be the case long ago if it were so.

I may just mention that as far as I have been able to compare the two modes of Davy and Liebig, I find a close agreement for the higher sp. gr. urines, but a great difference with the more dilute.* Thus, urine sp. gr. 1024, full-coloured—

By Liebig, gave 15·920 grains of urea per ℥i.
By Davy, „ 16·640 „ „

Urine sp. gr. 1007, pale, clear—

By Liebig, ℥i gave 5·250 grains.
By Davy, ℥i „ 2·636 „

Urine sp. gr. 1029, paleish, latentious—

By Liebig, ℥i gave 16·125 grains.
By Davy, ℥i „ 17·224 „

Urine sp. gr. 1018, albumen separated—

By Liebig, ℥i gave 10·500 grains.
By Davy, ℥i „ 9·760 „

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* Dr. Von Bose has also made some observations on the proportions of urea in the same specimen of urine, indicated by the two methods. Ten cubic centimetres of six different specimens of urine gave according to these methods the following results:—

	Liebig's Method.	Davy's Original Method.
1	·365 gr.	·310 gr.
2	·335 „	·260 „
3	·370 „	·295 „
4	·295 „	·269 „
5	·247 „	·231 „
6	·220 „	·253 „

OF MAKING TRANSPARENT TISSUES MORE OPAQUE, AND OPAQUE TISSUES MORE TRANSPARENT.

By the Editor.

MANY tissues which are perfectly transparent, and apparently structureless when subjected to ordinary examination, can be shown to possess a peculiar structure if treated with some chemical reagent which has the property of rendering them more or less opaque. Thus, the addition of a little alcohol often demonstrates the presence of a membrane where none could be seen previously. Chromic acid, as is well known, exerts a similar effect in rendering perfectly transparent structures composed of an albuminous substance, granular, and often demonstrates an arrangement of the tissue which was before invisible. The transparent vitreous humor of the eye, was shown by Mr. Bowman to possess a curiously lamellated arrangement, by the action of acetate of lead. Acids and many salts, such as alum, acetate of lead, acetate of alumina, solution of sesquichloride of iron, &c., effect a very important alteration in many perfectly transparent tissues.

Sometimes the mere addition of a coloured solution is sufficient to render a tissue perfectly distinct which before was too transparent to be visible. A little Prussian blue or lamp black, diluted with much water, or a solution of carmine in ammonia, used in a very dilute state, will in some instances enable the observer to demonstrate the presence of basement membrane, which could not be seen before, if the structure be allowed to soak in it for some little time.

The most important *chemical* agents for rendering tissues *more transparent*, are acids and alkalies. Many structures, however, are made perfectly clear by being immersed in certain solutions of high specific gravity, which exert no *chemical* alteration on the texture. Syrup or glycerine may be used for this purpose, but I much prefer the latter, as it is not so liable to be invaded by fungi, while it forms a most excellent preservative solution. White fibrous tissue, which even in a very thin layer appears opaque when examined in most fluids, becomes perfectly clear and transparent after being soaked for a short time in glycerine.

The chief value of *acetic acid* in rendering tissues transparent, is due to its power of dissolving earthy salts, such as phosphate and carbonate of lime, and that of rendering transparent certain forms of albuminous matters, especially the

granular matter which exists within the cell wall in many instances. Acetic acid also causes white fibrous tissue to swell up and become perfectly clear, while all traces of its fibrous appearance is lost. On all varieties of yellow elastic tissue, however, it exerts no action.

Alkalies dissolve a great number of coagulated albuminous principles, and many opaque tissues are rendered perfectly transparent if acted upon by an alkali. The principal alkaline solutions used by the microscopist are *carbonate of potash*, *liquor potassæ*, and *liquor sodæ* (solutions of hydrate of potash and soda in water). These are employed of different strengths. They dissolve many opaque albuminous substances, if used very strong, and if diluted, render them clear and transparent. Sometimes it is desirable to render fibrous tissue transparent, in order to observe the character of certain earthy phosphates, or other substances imbedded in it, which are known to be soluble in acetic acid. In such a case alkalies are employed. Instances of the application of acids or alkalies to the same end might be alluded to, but the particular advantages of one or other class of reagents will be brought forward.

Of rendering Soft Tissues Hard and Transparent.

There are very many solutions, several of which have been already referred to, which have the property of hardening soft tissues, but as their action depends principally upon the formation of insoluble albuminous compounds which are opaque and granular, but few are applicable to microscopical purposes. Alcohol, and various saline solutions, as alum, bichloride of mercury, arsenious acid, &c., render most tissues too granular and opaque for microscopical observation. A very dilute solution of chromic acid of a pale straw colour, is useful for hardening many textures, but in most instances a compound fluid, consisting of a mixture of two solutions—of which, one has the property of precipitating albuminous substances in an insoluble state, while the other tends to dissolve them—is to be preferred. Such a solution hardens a tissue effectually, but at the same time renders it transparent. If desirable, the refractive power of such a fluid may be increased by the addition of glycerine, and with a little trouble, fluids suitable for the examination of almost every structure may be made. The solutions which I have used, are the following: alcohol, glycerine, acetic, nitric, and hydrochloric acids, potash, and soda. Now alcohol, hydrochloric and nitric acids render many transparent albuminous textures, granular and opaque, and as is well known, produce precipitates in albuminous solutions;

alcohol will, however, dissolve many fatty substances. Acetic acid, potash and soda, cause many albuminous tissues, which are more or less opaque or granular, to become clear and transparent, and dissolve insoluble precipitates of certain albuminous compounds. Glycerine, in consequence of its high refractive power, renders many tissues, which in their natural state are opaque, perfectly clear. By mixing together some of these solutions, having opposite properties, compound fluids may be obtained, which will exert different effects upon tissues according to the proportion of the different constituents they contain. A mixture of alcohol and acetic acid, renders sections of the spinal cord and nerves so beautifully transparent, that many new points in their minute structure have been demonstrated, which, as far as is known, can be distinguished by no other process. This solution was employed by Mr. Lockhart Clarke in his beautiful investigations on the spinal cord. It was only after a very laborious course of investigation and repeated trials of every kind of admixture which he thought likely to produce the desired end, that Mr. Clarke hit upon this most useful fluid. In his very first paper, before he had carried his observations upon the anatomy of the cord to any very great extent, he described minutely the manner in which his specimens had been prepared, and thus liberally gave his fellow-labourers the advantage of carrying on investigations in this wide field of inquiry, although he himself had but only commenced his researches. Dr. Lenhossek, of Vienna, has adopted Mr. Lockhart Clarke's plan, and has made some very beautiful specimens, which he exhibited in London a short time since.*

No better example than this can be adduced of the great value of studying the chemical and physical characters of the tissues, and endeavouring to overcome, by particular methods of investigation, the impediments which exist to the successful demonstration of the anatomy of many structures.

The solution employed by Mr. Clarke, is composed of three parts of alcohol and one part of acetic acid. The proportions may be varied according to the properties which the new fluid are required to have.

Alcohol, Acetic Acid, and Nitric Acid.—By the addition of a little nitric acid, a fluid may be obtained which has been found very useful in investigations on the different forms of epithelial cells. One of these fluids was composed of the following ingredients; but of course useful modifications will occur to the mind of every practical observer, according to the properties

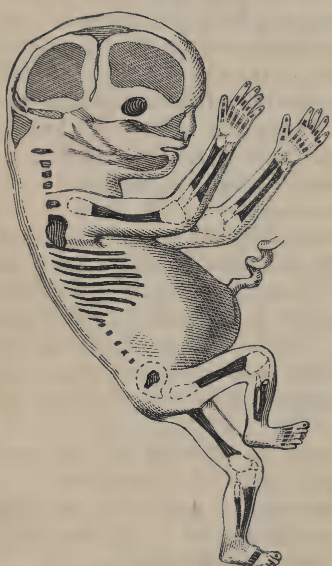
* These are now in the Museum of the Royal College of Surgeons.

which he desires it should possess, and it is therefore only necessary to give the composition of one or two:—

Water	1 ounce.
Glycerine	1 „
Spirit	2 ounces.
Acetic acid	2 drachms.
Hydrochloric acid	½ drachm.

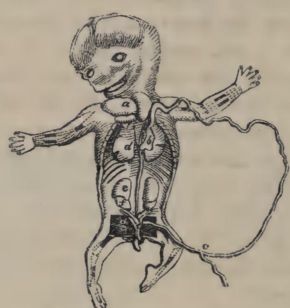
Alcohol and Soda.—In many investigations I have obtained excellent results from the use of a fluid composed of alcohol and solution of caustic soda, in the proportion of eight or ten drops to each ounce of alcohol. Many tissues are, at the same time, rendered very hard and transparent in such a mixture, and

Fig. 19.



Human Fœtus, about the eleventh or twelfth week. Ossific points are observed of considerable size. But one point exists in the os innominatum and two are seen in the scapula. The shading in the head and face indicates the formation of bone. The ossification of the first and third phalanges of the fingers and metacarpal bones has advanced, but at present there is only one point of ossific deposit in the tip of the great toe and one for the middle toe. In both drawings the development of the anterior extremities is much more advanced than that of the legs. Soaked in soda and alcohol for a few days, and preserved in spirit. Not changed since 1853–4. Natural size.

Fig. 20.



Human Fœtus, about the eighth or ninth week of intrauterine life, soaked in alcohol and soda, and preserved in glycerine. *a.* Heart. *b.* Stomach. *c.* Intestine, not yet much longer than the body. The branch below the letter, is the remains of the omphalo-mesenteric duct. *d.* Lungs. *e.* Supra-renal capsules. *f.* Kidneys. *g.* Remains of Wolffian bodies, with ovaries and genital ducts. Points of ossification are observed in the humerus radius, ulna, last phalanges of the fingers, femur, tibia, and ribs. The ossification of the clavicle is advanced, but no ossific points are yet to be detected in the feet. Natural size.

it is particularly adapted for investigations upon the character of calcareous matter deposited in tissues in various morbid

processes. It is especially useful in tracing the stages of ossification in the early embryo. It renders all the soft tissues perfectly transparent, but exerts no action on the earthy matter of bone. The most minute ossific points can therefore be very readily discovered. This fluid is also advantageous for investigation upon the development of various tissues and organs, as it renders the texture hard without making them opaque and granular. I have soaked embryos not more than a month old in the fluid prior to dissecting them. A fœtus, prepared by being soaked for a few days in this fluid, and preserved in weak spirit, forms a very beautiful preparation. A drawing of one, about the end of the third month, is given in fig. 19, and in fig. 20 one about the end of the second month is represented. The first was prepared four years ago (1853–4), and perfectly preserves its transparency. The practical advantages of such a plan over the usual very laborious process of dissection, in investigating the periods of ossification in various bones, are obvious. This fluid will be found very useful in investigations upon soft glandular organs. I found it of especial service when working at the anatomy of the liver.*

On mounting Moist Tissues in Canada Balsam without being dried previously.—Moist tissues may be mounted in Canada balsam without being previously dried, by the use of these alcoholic solutions. As is well known, Canada balsam will not permeate a tissue moistened with water; but the water may be removed by soaking in an alcoholic solution of acetic acid or soda, which does not alter the albuminous materials. When well saturated, the alcoholic solution, which now contains a little water derived from the specimen, may be changed for a little fresh fluid, and after the specimen has been allowed to soak for some time in this, it may be removed to a solution of Canada balsam in ether. The ethereal solution drives out the alcohol, and after the preparation has been placed once or twice in fresh portions of solution, it may be placed on a glass slide. The ether gradually evaporates, but the tissue remains thoroughly impregnated with Canada balsam. A little fresh balsam may be added, and the specimen mounted permanently. This plan was first used by Mr. Lockhart Clarke, for the preservation of his specimens of the spinal cord, and has been subsequently adopted by Dr. Lenhossek. Thus, although Canada balsam does not possess the property of wetting a tissue containing an aqueous fluid, it and similar media may be made to permeate it. In carrying out investigations of this kind, the following circumstances must be borne in mind. Alcohol mixes with water,

* "On the Anatomy of the Liver," p. 2.

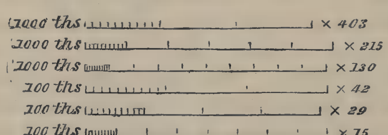
ether with alcohol, Canada balsam with ether. The first removes the water, the second replaces the alcohol, and the last being readily soluble in ether, may be thus introduced into the interstices of the tissue. The ether is allowed to evaporate, and the specimen preserved in Canada balsam in the usual manner. By pursuing a similar plan, other tissues may be thoroughly impregnated with fluids, which under ordinary circumstances do not possess the property of wetting them.

NOTE ON MEASURING OBJECTS.

THE plan of appending scales to microscopical drawings, magnified by the same lens employed for making the drawing, has been described in No. I, page 7. The scales referred to are made by tracing, with the aid of the neutral tint glass reflector, from the lines of a stage micrometer placed in the field of the microscope. It is better to construct at once, on a piece of card, a table of the micrometer lines magnified by all the different powers, and from this the gummed slips may easily be made, and one cut off when required, and placed beneath every drawing.

The focal length of the different object-glasses and their magnifying power is given below.

Fig. 21.



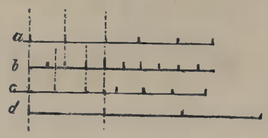
1000ths and 100ths of an English inch magnified in various degrees. The smallest divisions indicate 10,000ths and 1000ths of an inch.

The eighth-inch magnifies	403 diameters.
The quarter-inch	215 ,,
The half-inch	130 ,,
The inch	42 ,,
The two inch	29 ,,
The one glass of two inch	15 ,,

The above table is of use only for drawings made by my own glasses. Every observer must construct such a table for himself. The only instruments required for the purpose are a

stage micronometer, divided into 100ths and 1000ths of an English inch, a neutral-tint glass reflector, made to fit on to the eye-piece of the microscope which is placed in the horizontal position, and a pair of compasses. The following cut indicates the manner in which the magnifying power of object glasses is calculated.

FIG. 22.



a. 1000ths of an inch magnified 200 times.
b. Inch scale divided into tenths.
c. 1000ths of an inch magnified 130 times.
d. 100ths of an inch magnified 40 times.

Each magnified 1000th of an inch covers two-tenths, or one-fifth of an inch, therefore the glass magnifies 200 times, for $\frac{1}{1000} \times 200 =$ two-tenths, or one-fifth of an inch. Each 100th of an inch covers four-tenths of an inch, therefore the glass magnifies 40 times for $\frac{1}{100} \times 40 =$ four-tenths.

These remarks are added in answer to questions with reference to the paper in the last number.—[EDITOR.]

CARMINE INJECTING FLUID.

IN the hands of Mr. Smee, Professor Gerlach, and others, carmine has long been employed for making minute injections with the most satisfactory results. The solution is made by adding a few drops of *liquor ammonia* to a little carmine, when a beautiful violet coloured solution is produced. This may be diluted to the required tint, and injected. It is most applicable to injecting very delicate vessels, as those of the brain; indeed, if much force be employed, the fluid transudes through the walls of the vessels, and tinges all the neighbouring tissues indiscriminately. The fluid is much improved, and its tendency to transude diminished, by the addition of glycerine and a little alcohol. I had long wanted a transparent injection which could be used for injecting some vessels, while others in the same preparation were injected with Prussian blue. Professor Gerlach has made some beautiful double injections of the portal and hepatic capillaries, by injecting one set of vessels

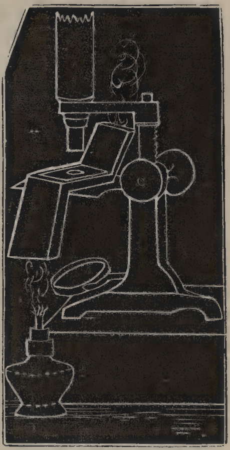
with carmine, and the other with Prussian blue. One of these he kindly sent me by my friend, Dr. Harley, but as Professor Gerlach's preparations were dried and mounted in Canada balsam, there are many important points in the structure which cannot be made out. If it is attempted to preserve such a preparation in the moist state, it soon becomes destroyed. The alkali of the carmine injection always destroys the blue colour of the Prussian blue, while if acid be added to the carmine previously, a precipitate unfavourable for injecting the capillaries is produced. After trying a great many different combinations to effect this object, I arrived at the following, which answers the purpose exceedingly well:—

Carmine	5 grains.
Glycerine, with about eight or ten drops of hydrochloric acid	½ ounce.
Glycerine	1 „
Alcohol	2 drachms.
Water	6 „
Ammonia, a few drops.	

Mix the carmine with a few drops of water, and when well incorporated, add about five drops of *liquor ammonia*. To this dark red solution, about half an ounce of the glycerine is to be added, and the whole well shaken in a bottle. Next, very gradually, pour in the acid glycerine, frequently shaking the bottle during admixture. Test the mixture with blue litmus paper, and if not of a very decidedly acid reaction, a few drops more acid may be added to the remainder of the glycerine, and mixed as before. Lastly, mix the alcohol and water very gradually, shaking the bottle thoroughly after adding each successive portion, till the whole is mixed. This fluid, like the Prussian blue, may be kept ready prepared, and injections may be made with it very rapidly.

ON EXAMINING OBJECTS IN THE MICROSCOPE AT A HIGH TEMPERATURE.

Fig. 23.



Apparatus for examining objects under the microscope while exposed to the influence of a high temperature.

In some investigations it is necessary to examine an object in the microscope while it is exposed to the influence of a high temperature. In some experiments in which I have been engaged recently this has been effected as follows. A flat copper tube, of the form represented in the drawing, is placed upon the stage. The lower wall of the tube in the part corresponding to the field is made of glass, while a circular or oval opening is made above. Over this the glass slide with the objects is placed. Upon placing a spirit-lamp beneath as represented, the slide soon becomes warm from exposure to the heated air.

ON THE IMPORTANCE OF ASCERTAINING THE SPECIFIC GRAVITY AND AMOUNT OF SOLID MATTER OF THE BRAIN IN HEALTH AND DISEASE.

The researches of Dr. Bucknill, Dr. Sankey,* and others, have shown that the density of the brain varies considerably in different conditions. The specific gravity of the entire organ is in many cases affected, but it is obviously of the first importance to ascertain the density of the different parts separately. In this manner various parts may be proved to have suffered in nutrition, although no structural changes can be detected, even with the microscope. The specific gravity of the entire brain in health is about 1039; in cases of paralysis it is much higher, but varies from 1036 to 1050.

From very numerous observations, Dr. Sankey has ascertained that the average specific gravity of the grey matter is

* Dr. Bucknill, Lancet, December 25, 1852. Dr. Sankey, British and Foreign Medico-Chirurgical Review, January, 1853.

1034 in both sexes, while the mean specific gravity of the white matter is 1041.

Dr. Aitken * has ascertained the specific gravity of the central parts of the brain to be as follows: the central ganglia 1040 to 1047; the cerebrum from 1030 to 1048; the cerebellum from 1038 to 1049. In a case or chronic hemiplegia the specific gravity of the corpus striatum and optic thalamus on the right or sound side was 1025, while the same parts on the left or paralysed side were 1031. It is desirable that the specific gravity of the different parts of the brain in health should be ascertained by an extended series of observations, as it is probable that very important results would be arrived at by comparing the numbers with those obtained in cases of disease.

Method of ascertaining the Specific Gravity of the Brain.—The specific gravity is ascertained by placing little pieces of the brain, about the size of a small nut, in solutions, the density of which has been previously taken. A number of saline solutions are prepared, varying in specific gravity from 1025 to 1055. The salt is dissolved in a considerable quantity of water, and the density of the solution ascertained with an accurately graduated hydrometer, or with the specific gravity bottle. To a portion of this solution more water or salt is added, as the case may be, and the specific gravity is again ascertained as before. These are diluted until we have prepared a number of solutions, which may be preserved in separate bottles, each having the specific gravity of the solution it contains marked upon it. When an experiment is made, a little of each solution is poured into small glasses placed in regular order; the piece of brain is to be placed in one, and if it rises to the surface it must be tried in the next lighter one above it; but if it sinks to the bottom it must be removed with forceps and placed in a more dense solution. After a few trials a solution will be found in which the morsel neither sinks to the bottom, nor swims on the surface. The weight of equal bulks of the brain and of the fluid is the same, and the specific gravity of the fluid used, which is known, indicates that of the brain, which is required.

Solutions of chloride of sodium were first employed, but Dr. Aitken recommends sulphate of magnesia. Glycerine would also answer the purpose well, but the expense of the solution would be too great. The same portion of fluid should not be used for more than one or two experiments.

Important results are also to be obtained by ascertaining the proportion of solid matter in different parts of the brain in

* Dr. Aitken, Glasgow Medical Journal, No. I, 1853.

various cases, and extended observations upon the proportion of fatty and saline matters would in all probability yield valuable results.

The per-centage of solid matter in different parts of a brain which may be concluded to be healthy,* is shown in the following table:—

White matter of cerebellum—	
Water	67·27
Solid matter	32·73
White matter of hemispheres—	
Water	69·45
Solid matter	30·55
Medulla oblongata—	
Water	73·75
Solid mater	26·25
Optic thalamus—	
Water	74·60
Solid matter	25·40
Gray matter cerebellum—	
Water	79·94
Solid matter	20·06
Corpus striatum—	
Water	79·96
Solid matter	20·04
Gray matter of convolutions—	
Water	80·58
Solid matter	19·42

The following cases show how the proportion of water and solid matter may vary in disease.

1. Brain of a child, age 6 weeks. Cause of death unknown. Body generally well nourished; viscera all healthy; brain very soft, though examined within 8 hours after death,—of a waxy appearance.

Water	89·60
Solid matter	10·40

2. Brain of a girl, æt. 19, who died of diabetes. The brain was very firm, and no morbid appearances were observed. The white and grey matter contained

Water	74·85
Solid matter	25·15

* The brain was obtained from the body of a man who was in good health at the time, and was killed by falling from the top of a house. He died about eight hours after the fall.

3. Brain of a woman, age 40, who died of apoplexy.* White matter of cerebrum apparently healthy.

Water	71·4
Solid matter	28·6

4. Softened cerebral matter surrounding the clot.

Water	81·49
Solid matter	18·51

5. Brain of a girl, aged about 12, who died from induration of a portion of white matter of the anterior lobe of the left hemisphere, about the size of a walnut.

Indurated portion—	
Water	75·24
Solid matter	24·76

6. White cerebral matter from the opposite side, and from the same side as that in which the indurated portion was situated.

Water	80·29
Solid matter	19·71

7. Brain in which there was an indurated portion in the anterior part of one hemisphere.

Indurated portion, sp. gr. 1042—	
Water	81·59
Solid matter	18·41

8. Anterior portion of opposite hemisphere which was healthy. Specific gravity, 1044.

Water	70·29
Solid matter	29·71

OF VESSELS FOR KEEPING CANADA BALSAM IN.

THE tubes, made of thick tin-foil, used for artist's colours, with a small cap that screws on to the top, are very convenient receptacles for the preservation of Canada balsam. As they contain no space for air, the balsam does not become hard and unmanageable, as is too often the case when it is kept in bottles or tin pots. There is no necessity for using a glass or metal rod, as the quantity of balsam required can always be forced out without the slightest difficulty. Other cements and varnishes can be kept in them also for any length of time. It is as well, however, to keep them in an upright position, to prevent the cement from running into the thread of the screw, and so fixing the top too tightly.—[Mr. J. W., Suffolk.]

* Case reported in page 46.

JOURNALS WITH WHICH THE "ARCHIVES OF MEDICINE" IS EXCHANGED.

Glasgow Medical Journal.

Journal de la Physiologie de l'Homme et des Animaux, publié sous la direction du Docteur E. Brown Séguard.

American Medical Monthly.

Quarterly Journal of Dental Science.

Ophthalmic Hospital Reports and Journal of the Royal London Ophthalmic Hospital.

⁂ The Editor will be happy to exchange with other Journals. Communications to be sent to 27, Carey Street, W.C., London.

BOOKS RECEIVED.

Aitken, Dr., the Science and Practice of Medicine. Griffin, London and Glasgow.

J. C. Nesbit, Agricultural Chemistry. Longman and Co.

Joseph Lister, F.R.C.S., &c., On the Minute Structure of Involuntary Muscular Fibre. From the Transactions of the Royal Society of Edinburgh.

Joseph Lister, F.R.C.S., &c., On the Early Stages of Inflammation. Abstract.

Charles Isaacs, M.D., &c., Researches into the Structure and Physiology of the Kidney.

Charles Isaacs, M.D., &c., On the Function of the Malpighian Bodies of the Kidney. From the Transactions of the New York Academy of Medicine.

J. Lawrence Smith, M.D., &c., The Inverted Microscope. From the American Journal of Science and Arts.

North American Medico-Chirurgical Review. Edited by Drs. Gross and Richardson, Philadelphia. Trübner and Co., London, Nos. 1 and 2, 1858.

Quarterly Journal of Dental Science. Walton and Maberly.

Professor Donders, Onderzoekingen gedaan in het Physiologisch Laboratorium der Utrechtsche Hoogeschool, Jaar VII.

American Medical Monthly. Edited by Drs. Parker and Douglas, New York, Vol. IX, Nos. 1, 2, and 3.

Dr. Murchison on Gastrocolic Fistula, from the Edinburgh Medical Journal, July and August.

Dr. O'Ferrall, Clinical Lecture on the Treatment of Anthrax, by Pressure. From the Dublin Hospital Gazette.

Dr. Inman, The Phenomena of Spinal Irritation. Churchill.

Dr. Darling. Case of Monstrosity. New York.

Adams On Subcutaneous Surgery. Churchill.

Dr. M. Billroth, Einige Beobachtungen über das Ausgedehnte Vorkommen von Nervenanastomosen im Tractus Intetestinalis.

Dr. M. Billroth, Uber die Epithelial zellen der Froschzunge, sowie über den Bau der Cylinder und Flimmen-epithelien und ihr Verhältniss zum Bindegewebe.

Joseph Lister, F.R.C.S., On Spontaneous Gangrene from Arteries and the Causes of the Coagulation of the Blood in Diseases of the Blood-vessels.

Dr. Child, Oxford, A Letter to the Rector of Exeter on some proposed Changes in the Residence required by the University for Degrees in Medicine.

Dr. Pinkerton, On the Spread of Cholera by Personal Communication.

⁂ No. III will be published in October. The attention of Contributors to the Notice at the commencement of the present number is particularly requested.

CLINICAL OBSERVATIONS.

ON THE CHANGE OF FORM IN THE CHEST IN CASES OF DISEASE.

By S. Scott Alison, M.D.,
Assistant Physician to the Hospital for Consumption and Diseases of the Chest, Brompton.

Part II.

(*Continued from page* 70.)

In the last number of the 'Archives of Medicine,' some observations were made upon the means usually employed in the mensuration of the thorax. The form of the healthy chest was considered. An instrument, the stethogoniometer, which the author has employed in measuring the curves and angles of that region was described, and the advantages it possesses and the mode of using it were pointed out. It now remains to describe some of those deviations from the natural form of the chest which the stethogoniometer is able to detect and measure as well for future comparison as for present consideration.

In doing this, the history of those deviations only which proceed from disease of the internal soft parts will be given. But it is right to observe that deviations from the normal form arising from disease of the thoracic bones themselves from spinal curvature or from occupation or posture are equally well measured by this instrument.

The deviations now to be considered will be found to relate to pulmonary consumption in an especial manner. The author's

observation of such deviations has been extensive from his connection with the Brompton Hospital, and a knowledge of them will naturally be interesting and valuable from the great frequency of this disease.

The departure from the healthy form occurs at an early period of the progress of pulmonary consumption, and will in many cases where there is a deficiency of acoustic signs, prove, as it has often done to the author, an aid of some value and deserving of some reliance; while the departure of the early stage becomes as the disease progresses a striking and remarkable deformity, testifying to the wonderful modelling powers of morbid soft structure even upon hard osseous and cartilaginous parts, and, as will be seen at a later period of this communication, not only assisting in diagnosis but actually subserving the process of reparation and of cure.

Bayle long ago pointed out that in chronic phthisis the chest became retracted. M. Laennec described the retraction of the ribs when the walls of large abcesses and tuberculous cavities contracted. The fulness and roundness in empyema, with the alteration of the transverse plane of the ribs, the contraction of the chest on the absorption of the effusion, and the flattening of the upper and anterior portion of the thorax as a frequent attendant upon advanced pulmonary consumption, as well as various alterations from internal tumours are well known to the profession. But the author believes that alterations occur at an earlier period of phthisis than has been taught by any writer,—that, in fact, the flat chest which has been held to predispose to phthisis is the consequence of it. Certain deviations, he believes, have not been described at all, and their mode of production, their relation to certain symptoms, and their salutary influences as defences of life, have received little attention. On these grounds, this contribution may be justified.

The frequency of acquired deformity of the chest from disease of the contents of that cavity is very great. Of one hundred of the author's out-patients at the Brompton Hospital, fifty-three presented certain abnormal deviations from the natural form of the chest. Of the remaining forty-seven patients, whose chests were normal, only nineteen suffered from phthisis, seventeen of whom were in the first stage, one in the second, and one in the third. The affections of those other persons who had the chest in a normal condition were chiefly bronchial and cardiac.

I. The deviation which is most common is a general flattening

of the entire front of the chest, including the sternum in the middle and the costal cartilage and the ribs for a space of an inch or two on either side. The two sides are generally symmetrical, or nearly so. The sternum has lost much of its gentle convexity on the exterior, and becomes nearly straight from above downwards, assuming too, almost the perpendicular direction. This bone appears to have permanently approached somewhat nearer the spinal column than is natural. The costal cartilages have lost much of the roundness of their outlines. The second and third cartilages are often found perfectly flat. The lower cartilages, which in the healthy form frequently rise and form a crust on either side of the sternum, both laterally and from above downwards are found divested of much of their prominence. The clavicles may retain their normal position or decline. The dorsal spine is usually found normal, or only a very little more rounded posteriorly than natural, but in some instances the dorsal spine has its convexity materially increased, and it approaches the form of the gibbous back. The extent of the rise and fall of the front part of the chest in respiration is materially reduced, but the abdominal movements are augmented.

It is in phthisis that this deviation is most frequently found. It is comparatively seldom the result of internal thoracic disease without the presence of signs of tubercles of the lungs. The following table will serve to shew at a glance the comparative frequency of this deviation in 74 examples of disease, which I have taken in strict succession from my Hospital book.

Phthisis.	Doubtful Phthisis.	Bronchial Affections.	Dyspnœa.	Heart Disease.
66	3	2	1	2

Of 63 other cases of phthisis, 44 were associated with abnormal deviations, and of these 21 had double flattening.

The flattened chest, or what, for the sake of distinction, may be called the double-flattened chest, is found very early in phthisis and comparatively seldom in the more advanced stages, at least as the leading deviation. In the second and third stages it is replaced by other deviations of a more local and more striking character. The following table shews the pro-

portion of 66 cases of double-flattened chest to each stage of phthisis.

1st Stage.	2nd Stage.	3rd Stage.
49	12	5

In the 49 examples of double-flattening of the chest in the first stage of phthisis, signs of tubercle in both sides were found in 40, while in only 9 were the signs completely restricted to one side. It is true that in most of the 40 examples of double phthisis the signs were more marked and the disease further advanced on one side than on the other. Of 12 cases of this deviation found in the second, or softening stage of phthisis, in 6 the disease was double and in the same number it was single. In 5 examples of this departure from the healthy conformation occurring in phthisis at its third stage, good-sized cavities were found on one side, but there was in all the cases, implication, though not always to a great extent, of the opposite lung.

The female sex appears to present in a special manner the double-flattened chest. Of 74 examples, only 29 occurred amongst males, being a rate of 39·1 per cent., while 45 were found in females, being a rate of 60·8 per cent. This excess in females does not extend to all deviations: in 152 examples of all kinds of deviations, 81 males suffered and only 71 females, or at the rate of 46·7 per cent. of females to 53·2 per cent. of males. And the proportions are reversed in single flattening, or flattening on one side, for of 43 examples 33 occurred in males and 10 only in females, or at the rate of 76·7 per cent. in males and 23·2 per cent. in females.

Proportionate rate per cent. of sexes in double and single-flattening, and in all deviations.

Double Flattening.		Single Flattening.		All Deviations.	
Males.	Females.	Males.	Females.	Male.	Female.
39·1	60·8	76·7	23·3	53·2	46·7

At all ages the double-flattened chest is observed: comparatively few examples have been seen in childhood. Of the 74 cases, only 2 were found in persons at 10 years and under. No example in the 74 cases was found at 50 years or upwards. A large proportion of the ages ranged from 25 to 35 years. The average of the whole was 29 years and 2 months. The average age of males was somewhat higher than that of females, being 30 years 4 months, while that of females was 28 years and 5 months. The average age of 74 persons having the double-flattened chest is rather lower than that of 47 persons, who had normal chests. The average of the former was 29 years 2 months that of the latter 32 years 3 months. The average age of the 74 persons with double-flat chests is much the same as that of 43 persons with single-flat chests, to be afterwards referred to. The former is 29 years 2 months, the latter 29 years 11 months. The average age of males with double flat-chests is slightly higher than that of males having single flat-chests, the former being, as before stated, 30 years and 4 months, that of the latter being 29 years and 9 months; but the average of females with double-flat chests is lower than that of females with single-flat chests, the former being 28 years and 5 months and the latter 30 years and 6 months.

The amount of flattening varies in different cases from a moderate yet obvious reduction of the natural convexity of the upper portion of the thorax both in a transverse and vertical direction. The centre of the stethogoniometer being placed upon the sternum, the two arms of the instrument placed upon the two sides of the chest respectively,—upon the second or third ribs, or between them, will be found nearly in a straight line. If the centre of the instrument be placed upon the costal cartilages the angle to the tangents of the curves will frequently be found 175°, being, so to speak, nearly that obtained in measuring a plane.

The stethogoniometer is not essential in dealing with this deviation, for the eye alone is sufficient to detect it, but it is of use in discovering a little difference between the corresponding parts of the two opposite sides, and in affording an accurate measure for record, and for future comparison, such as no mere mental recollection can bestow.

The deviation which is under consideration is not to be confounded with that loss of rotundity which proceeds from mere loss of flesh. In this case the bones, if accurately traced, are found to retain their natural curves. Attention too is to be given to the fact that flattening may be due to congenital formation or to posture, as in occupation. The evidence of the

patient will serve to prevent error. The unhealthy flattening is frequently so marked that patients themselves will declare that their ribs and breast-bone have fallen in.

Though the flattened double chest is very generally associated with phthisis, and more particularly with it in its first stage, it is occasionally seen in mere bronchial affections, as will appear by reference to the table of diseases associated with the 74 cases treated of.

In examples of double-flattened chests, pleural adhesions are, for the most part, found only at the apices, and in some cases only on one side of the chest.

The mechanism of the production of flattening in phthisis appears to be this. Masses of tubercular deposit, larger or smaller, and more or less numerous, having been deposited in the summit of one or both lungs, the admission of air into the vesicles thus occupied is of course prevented, and as the bulk of cells occupied with tubercular deposit is less than the bulk of cells filled or distended with air, the chest in the vicinity of the tuberculated lung, if the diseased portion be at all considerable, and such as cannot readily be compensated by the adjoining healthy structure, fails to rise in the act of inspiration. This will account for the loss of that fulness that obtains in full inspiration, but beyond this there is a flattening or actual sinking, apparently beyond the flattening of healthy expiration. The tuberculated lung occupies less space than the healthy lung which has just taken part in the act of ordinary expiration, frequently less than the lung which has taken part in a forced expiration. The lung under the process of tuberculization has actually undergone a contraction, and its tendency is to leave the walls of the thorax, but from the operation of the pressure of the external atmosphere and the elasticity of the cartilaginous and more yielding osseous parts of the chest no separation takes place, and these parts follow the retiring lung, and give rise to the flattening which we observe. The flattening seems likewise to be due in some measure to the fact that persons afflicted with phthisis at its commencement, purposely avoid making deep inspirations, and take into the lungs the necessary quantity of air in restricted and more frequent draughts. This substitution of restricted and more frequent for longer and less frequent inspirations will naturally be attended by a less complete distension of the air cells, and they, from their natural elasticity, will somewhat contract and draw the thoracic walls with them. In this way we shall be enabled to account for the disproportion which frequently seems to exist between the amount of deposit and the amount of flattening, the latter being the larger quantity.

It will also serve to account for the flattening occurring on both sides of the chest in nearly equal amounts, when there is reason to believe that the disease of the lung is confined to one side, or is much greater on one side than on the other. The patient is led to make short and more frequent inspirations, warned by the fact that full respiration is attended with local distress and sometimes with pain.

The general flattening in phthisis and some other diseases is promoted by habits of stooping and holding the head and shoulder forward, as assistance in respiration seems to be obtained in this way. And it is to be observed that flattening of the chest may arise to some extent from weakness or listlessness, causing the stooping posture to be assumed.

The flattening of the healthy side, which is seen to attend the flattening of the unhealthy side, is occasionally overcome, and the healthy side returns to its normal configuration, or it may even manifest an abnormal elevation and expansion. This takes place when the lung, free from tubercle, taking upon itself the duties of the disabled organ, becomes hypertrophied, and carries on a compensatory respiration known as puerile breathing.

The flattening of the chest, and consequently the diminished power of distending the lung with air, appears not without some solid advantages to the patient. If the cells still free from tubercle and yet adjoining solidified structure were to be fully distended laceration must ensue, and, together with it, hemorrhage, more or less copious and more or less fraught with immediate danger to life. As the case stands the danger of laceration does exist, and doubtless this accident frequently takes place and proves the cause of hemorrhage in many cases, but the danger is greatly obviated by the reduced capacity of inspiration which attends the flattened chest. When laceration is spoken of, that amount which would admit the finger, or that can be readily seen after death, is not meant; but only a fine division scarcely to be seen yet in such a vascular organ amply sufficient to produce serious hemorrhage. The flattening of the chest and the consequent reduced power of inflating the lungs, seem to be opposed to hemorrhage only so long as no adhesions exist between the thorax and the lungs. When extensive adhesions have taken place between the lungs not yet totally disorganized, and the apex and upper part of the thoracic cone, hemorrhage would appear to be invited. But of this the author has not yet been able to satisfy himself by the statistical test. Flattening with extensive adhesions, and a lung still vascular, would seem rather to favour hemorrhage by exposing to laceration when the diaphragm forcibly or suddenly contracts.

II. Flattening of one side of the chest is a very important deviation from the natural conformation. In its slighter degree it is easily recognized, but in its more advanced, it is very striking, and forms a very remarkable contrast with the opposite side. In its full development, it is significant of very serious disease; in most examples it is the attendant of cavities in the structure of the lung beneath, of cavities which may be large with or without any healthy pulmonary structure interposed, or of cavities which are contracting and reduced to a fraction of the size they once possessed. In not a few cases the greatly flattened side is the monument of cavities long obliterated by the contraction of their fibrous walls.

In the single flattened chest the parts most implicated are the first, second, and third costal cartilages, and the anterior portion of the corresponding ribs. The natural convexity of the part as measured by that of the opposite side is reduced. The angle of its tangents taken with the stethogoniometer is greater than natural by 5° or 10°. In many instances the instrument shows, so to speak, an angle of 180°, *i. e.*, of a plane. Beyond this the depression may go, and an actual hollow be observed. The convexity of the exterior of the costal cartilages is replaced by a concavity. The centre of the instrument held near the lowest part of the hollow, and as it were, opposite the apex of the curve, with its two arms held respectively on either side, and parallel with two tangential lines, the stethogoniometer will show an angle of 185° in many examples of healed or healing cavities. Fig. 1, Plate XI. in the first part of this paper exhibits this deviation.

Associated with flattening on one side there is frequently found a compensating abnormal fulness and convexity on the opposite side. This proceeds from increased expansion of the lung. Puerile breathing is common. This compensatory fulness takes place only when the corresponding lung is but little or not at all implicated in the tubercular deposition. The rise of the costal cartilages, just as they leave the sternum, is sometimes very striking. On this side there is ample movement, while on the flat side there is very little motion or even absolute immobility.

While the flattening of one side may justly be regarded as *the* deviation of the case, there is also sometimes found a slight degree of flattening on the other side, associated with some loss of expansive motion at the upper part of the chest. In this case while by far the greater amount of disease is present on the flat side, there is frequently found to be disease, though comparatively little advanced, on the more slightly flattened side.

In examples of great single flattening the loss of motion, though great, may be overlooked, for while the expanding movement of the ribs is reduced, and with it the expansion of the lung beneath, there is often present an increased movement of the clavicle and scapula, from voluntary exertions made to gain some little advantage in respiration, in some cases now become painfully difficult, and this may be observed more especially when the respiration of the patient is abnormally abdominal. The clavicles and scapulæ are frequently raised and fixed, in order to give greater effect to the inspiratory muscles, and to aid in the elongation of the thorax.

The flattened single chest, when limited in extent, and when marked in degree, is almost pathognomonic of phthisis, and when carried to a great degree, of phthisis in its third stage. Of late, in examining the chests of out-patients at the Brompton Hospital, the author has been able in numerous examples to predicate a cavity and its precise locality without putting a question, without percussion or auscultation, simply by ocular inspection, and by the discovery of the alteration under consideration. Of course the value of the prediction has in every case been tested by the usual examination. In examples of hepatization a great depression is found, but associated with this the shoulder is much depressed, and the base of the chest is contracted. In some examples of flattening, associated with hepatization, or that consolidation of lung which continues after empyema, the author has found signs of cavities, though doubtless small, surrounded by thick structures, and revealing themselves less plainly than in simple tubercular disease.

The value of flattening on one side is well illustrated by the following facts. Patients with this deviation have come to the hospital. Cavities have been strongly suspected, but the usual auscultatory signs have been defective. Months after, signs of large and evidently old cavities have been conclusively obtained.

The following table shows the proportions of 43 examples of single flattening to phthisis and other diseases :—

Phthisis, all stages.	Phthisis, doubtful.	Hepatization.	Bronchial Affections.
40	1	1	1

This deviation occurs in all stages of phthisis, but more especially in the third. It is common in the first, but in a less advanced degree. But it is in the third stage that the marked

form is most frequently observed. The following table shows the proportions of this deviation to each stage of phthisis out of 40 examples :—

Phthisis, 1st stage.	Phthisis, 2nd stage.	Phthisis, 3rd stage.
13	7	20

The observation of fewer examples of depression in the second stage than in the first seems to require some explanation, and is probably to be found in the fact that comparatively few persons come to the hospital in the second stage, the greater number coming in the first and third, a fact again explained by the shortness of the second stage compared with the others. The period of softening which comes between the two other stages is short, and is soon replaced by unequivocal signs of cavities of some considerable size, which with the author has been held to constitute the third stage. It may further tend to explain the paucity of this deviation in the second stage, if it be stated that the evidence of deviation was taken on the first examination and then only. This may also be held to argue that deviations are even more common than appears by the tables in this paper, for doubtless many persons in the first stage and in the second would, after a time, and after the evidence had been taken, become the subject of various alterations of the chest.

The frequency of the concurrence of cavity with the presence of flattening or hollowness on one side, is further well shown by the following table, which exhibits the form of chest in 39 examples of well marked cavities.

Table showing the form of chest in 39 examples of cavities :—

Form Chest.	Healthy.	Flat on one side.	Flat both sides.	Angularity one side.	Angularity two sides.	Total.
No. of Cases.	1	20	5	11	2	39

The almost constant attendance of flattening at least on one side in cavity cases, is further well illustrated by the following

facts ascertained a few days back, when the author was doing duty for Dr. Cursham and Dr. Thompson. Of eight women in one ward under Dr. Thompson, seven had cavities. Of these only one had a prominent and symmetrical chest, and her cavity had been only lately made out. The other six females presented one or other deviation; four had flattening marked, though not extreme; two had the ribs and cartilages angular at their junction, and the ribs retiring rapidly backwards on the cavity side. Of seven men—patients of Dr. Cursham—having cavities in the lung, not one was free from some deviation. There was flattening in four, and flattening with angularity in three. The deviations in the males were certainly more marked than in the females.

Great depression on one side is frequently to be found in persons who have very extensive cavities underneath, and yet have no inconsiderable amount of health and strength. In many such persons the complexion of the face is florid, or of a bright nut-brown colour, the condition in respect to adipose deposit, is that of *embonpoint.* The pulse is calm, and although the cavity be located on the left side, the impulse of the heart is increased in area, and is felt and even seen as high as the first interspace. It was only a few days ago that a young woman came to the hospital blooming like a country milkmaid, saying that she feared her disease might return if not attended to at once. The left subclavicular and mammary regions were found hollowed, and beneath was discovered an enormous cavity in the lung. This patient had been an inmate of the hospital on three different occasions. In a few days she was so well that she desired to be discharged.

Such facts as these, less marked, and they are constantly presented, requiring no colouring, have led the author to the conclusion that single flattening is part of a great healing and defensive process. The walls of the cavity come together, and the yielding hard parts follow, and the inflating chamber is reduced in magnitude. Unless the hard parts sank in, it would be comparatively difficult for cavities to heal. If the chest continued to expand, the cavity would continue to be alternately filled and emptied with every inspiration and expiration, and to the manifest injury of the diseased part and of the patient.

When marked flattening on one side presents itself, with material tendency to loss of flesh, however successfully combated for a time, and with failing health, particularly if associated with inclination of the one border of the sternum backwards, the author regards the presence of a cavity as almost certain, even in the total absence of pectoriloquy and gurgling. On subsequent

examinations these and other signs have converted a presumption into a certainty. It was only yesterday that a cavity large, old, and dry, was fully made out for the first time in a man who, on his first examination a month ago, presented flattening with one border of the sternum inclined backwards, but without one of the positive signs of that condition.

Flattening confined to one side, in a marked degree at least, has been found in the author's experience to be more frequent in males than in females, which is the reverse of what holds in the case of double flattening. Of 43 well marked examples of single flattening, 33 occurred in males and only 10 in females. The author cannot say that males display this distinction uniformly in excess. The excess here may be due to accidental causes, and would perhaps not hold in a larger number of observations. The excess in this collection of examples may be explained by supposing that men do not come to the hospital until their disease is further advanced than in women upon their first application. It may likewise be explained by supposing that males, having more power of endurance, live longer with cavities, and thus have more time afforded for retraction of the chest. The author has not yet been able to analyse the facts before him, so as to come to a satisfactory conclusion on these points. The greater power of the male constitution, favouring as it must do the deposition of false membrane, and of a more vitalized lymph, probably assists in making the depression more complete and more frequent in males; at the same time it cannot be forgotten that the greater pliability of the bones and cartilages of females must favour depression of the chest in them.

Single flattening occurs at all ages. It does not appear to be more common in childhood when the bones and cartilages are more particularly pliant than at middle age. Of the 43 examples of this deviation, 3 occurred at 10 years and under. Instances of greater age were found in this category than in the double flattening. One male was 56 years old, and other five persons had attained to 45 years and more. The average age of both persons was 29 years, 11 months. The average age of males was 29 years, 9 months; and of females, 30 years, 6 months.

The mechanism of single flattening or hollowing appears to be this. It is the mechanism which holds in double flattening, to which is superadded the mechanism of the retraction of the thorax in permanent hepatization and of pleurisy, or which follows empyema. In the third stage of phthisis much of the structure of the lung and much of the tubercular deposit is

expectorated, and a vacant space is left, called a cavity. When the parts which form the walls of this cavity are of tolerable thickness, and consist in great measure of thickened pleura and a mass of condensed lung structure, mixed up with much fibrinous deposit, and free from a copious admixture of mere friable ever detaching tubercle, the cavity contracts, and the walls drag the whole neighbouring parts towards them. The adjoining pulmonary structure and pleuræ pucker, the intercostal spaces are drawn in, and at length if life continue long enough, the costal cartilages and ribs are bent in under the persistent traction. The longer life continues, the greater and the more remarkable the flattening, or, as the case may be, the depression or the actual hollowing becomes, until the cavity has finally ceased to exist, and the blended walls no longer contract. The traction power of the walls of tubercular cavities and of abscesses in the lungs is quite sufficient to produce this deviation from the natural form of the chest, assisted as it is too by the atmospheric pressure from without. The author has known several examples of tubercular cavities nearly obliterated, and surrounded by a considerable mass of indurated lung structure, and surmounted by thickened pleura and false membrane attached to the anterior and superior portion of the thorax, to suffice not only to depress the ribs and cartilages, but to drag over to the right side of the sternum the heart, and to cause the hypertrophoid lung of the left side to invade the right side of the thorax. Dr. Walshe has pointed out this traction power exerted upon the heart. The author examined the body of a young man a year ago, who died under these circumstances: a small cavity in the right lung, surrounded by very hard cartilagenous-like lung tissue, the heart on the right of sternum, and the hypertrophoid lung of the left side inflated and resisting, invading the right side of the chest. More recently, a young woman, named Thrush, under the care of Dr. Cursham, died in the Brompton Hospital. During life the heart had been felt to beat much at the second right interspace.* The only structure at the right apex was a mass of hard contracted puckered material, composed of lung tissue, fibrinous deposit, and some cretaceous matter, the remains of a cavity. The right bronchus was very greatly dilated, having been doubtless occupied and distended with air, tending together with the dragged heart and the depressed ribs to occupy the space left vacant. A small tubercal cavity was found on the left side. A cavity

* I deem it due to Dr. Cursham to say that he has kindly given me permission to mention this case, and that he has on numerous other occasions placed his valuable materials at my disposal.

had doubtless been present on the right, but had become obliterated in the manner above described.

Pleural adhesions are generally present in cases of great flattening. The author has not seen any cadaver opened with this deviation to a material extent from the natural form, without finding such adhesions; but he inclines to the belief that they are not essential: the tendency to contract and to occupy a smaller space on the part of such lung and other structure as is under consideration, must necessarily be attended with a following of surrounding parts to an extent commensurate with their ability to move or yield, or, it may be, dilate like the hypertrophied lung, or a dilated bronchus.

All cavities do not tend to become less; some indeed even tend to become larger from the constant falling in of tubercle as the dimensions of a quarry increase by the constant falling in of fresh material. When the tubercle is in numerous masses of a friable nature surrounded by soft suppurating lung tissue, the cavity extends, until rib-ways there is nothing left but a thin membranous wall of pleura and not very firm coagulated lymph. In such cases very little or no flattening takes place from contraction of the walls of the cavity, and in some cases the author believes that instead of depression of the ribs progressing, as in the cases formerly referred to, the flattening which had taken place, during the period of crude tubercle tends to be reduced and the ribs are again disposed to rise under the influence of an increased respiration, not vesicular it is true, but cavernous, which admits a large amount of air with readiness under them within the flaccid cavity. The author believes he has seen the ribs rise and depression be reduced under the formation of such cavities. The lung rendered impermeable to air by the presence of tubercle, has become very readily pervious, nay, inflateable, like a bladder, by the rapid removal of a great mass of friable tubercle, now leaving thin expansile walls.

That such a tendency to expand exists, there is no doubt, not only during inspiration, but under other circumstances. During the act of coughing, how often has it happened to the author to see the process of expansion made visible by the forcible filling out of the intercostal spaces in hernia-like forms in cases of cavities with thin non-contracting walls during the act of coughing. The presence of cavities in such cases being sufficiently proven by the *bruit de pot fellé*, whispering superficial pectoriloquy, and other conclusive signs.

III. An angular condition of the articulations of the upper costal cartilages with the sternum is not unfrequently observed

as the product of disease. Instead of the articulations forming part of a gentle curve, in which the sternum and cartilages participate, they form angular points, whence the cartilages and bones depart at an angle varying in degree in different cases. The angle as measured by the stethogoniometer is frequently one of 160° or 155.° The part most affected is the second articulation counting from above. When the angle is sharp the articulation is sometimes found swollen, and resembles in some cases the mastoid process of the temporal bone. In this condition the part is generally tender. When this deviation is considerable, the costal cartilage retires fast backwards and may have lost much of its gentle convexity. The sternum maintains for the most part its transverse situation.

This deviation occurs on one side only, or on both sides. Of 32 patients, in whom this angularity was the prevailing deviation, and whose cases have been taken for analysis, 22 occurred on one side, and 10 on both sides.

The sexes suffer in nearly the same proportion. Of the 32 patients, 17 were males and 15 were females. Females seem to present angular deviation on one side as frequently as males, there being 11 of either sex, which is different from the case of single flattening, the number of males being 33, and of females 10, out of 43 well marked examples. This special fact, which perhaps indicates a more general fact, may be explicable by the greater narrowness of the female thorax and the consequent disposition to angular formations upon slight bending.

The angular feature may not be restricted to the articulations of the sternum and the cartilages. It is not unfrequently seen at the articulation of the ribs and the costal-cartilages. The parts seem at these points suddenly and abruptly to separate, and to pursue different directions. The angle is sharp, and may vary from 160° to 150°. These articulations are seldom swollen or painful.

The natural dimensions of the chest in such cases have for the most part been originally great from above downwards, rounded in the circumference, and decidedly narrow. This has been observed both in males and females.

This angular deviation has been noted at all ages, from the child, of either sex, to old age, but it has shewn a preference for children and those of them suffering from dyspnœa and bronchial affections as well as consumption.

Associated with this angularity on both sides or on one, there has been observed in many examples a decided sinking of the ribs from above downwards. This has been most striking when the deviation has been on one side only. It was then

more satisfactorily proven by the contrast afforded by the opposite side. In such cases the two upper ribs have sunk and a certain approximation to each other has been seen to hold with the three upper ribs. The clavicle, too, has sunk, retired rapidly back as it progressed outwards, and the articulation of the clavicle with the sternum was, as it were, opened and seemed to gape, so as to admit of the insertion between the two bones of the tip of the finger.

The angular deviations if recent, are generally associated with serious disease. In children the producing disease may be bronchitis, pneumonia, hepatization, or affections of the heart, attended with some impediment to respiration, particularly to inspiration. But in the majority of these examples which I have analysed, double marked phthisis was present.

Table shewing diseases and stages of phthisis in 10 examples of undue angularity of both sides.

Functional disease of heart.	Phthisis. 1st stage	Phthisis 2nd stage.	Phthisis 3rd stage.	Dilatation. of heart.
1	3	3	2	1

Of the above 8 examples of double angularity associated with phthisis, this disease was confined to one side in two only.

IV. Undue angularity on one side, if marked, is significant of serious disease, more than double angularity if moderate. Of 22 examples of the single form of this deviation, eleven or one half were associated with phthisis in its third or cavity stage.

Table shewing stages of phthisis and other diseases in 22 examples of angularity on one side.

Ph ?	Phthisis 1st stage.	Phthisis 2nd stage.	Phthisis 3rd stage.	Hepatization.	Bronchial affections.
1	5	3	11	1	1

The mechanism of angularity seems to be much the same as in flattening, with the addition of yielding or bending of the articulations. This additional feature is in part due to a greater narrowness in the chest that has been found to exist, or in other words to the front curve of the chest belonging to circles of smaller radii. The angularity seems likewise to be assisted by dyspnœa: the forced inspirations raise the sternum, while there is reason to believe the more free and loose parts of the ribs tend to be drawn inwards and downwards by exertions of the diaphragm, particularly when the articulations are not very firm. In some cases the sternum has appeared to be supported by the action of the external muscles the greater and smaller pectorals, while the diaphragm, and perhaps the triangularis sterni have depressed the ribs, &c.

V. Certain acquired prominences are occasionally seen in the configuration of the thorax. These proceed from internal tumours, from aneurism, and from enlargement of the heart. In plate XI, Fig. III. in the first part of this paper, exhibits a not uncommon form of projection from hypertrophy of the heart. Such a deformity is readily measured with the goniometer, and one side is accurately contrasted with the other.

VI. The sternum is very frequently the seat of deviation from its natural position and form. It is in childhood chiefly that deviation in form takes place. Instead of presenting a gentle convexity outwards and from above downwards, this bone may be perfectly plane or it may be concave. It is frequently raised and projecting throughout as in the pigeon-breast; the chief characteristic may be an angular prominence at the junction of the upper and middle portions of the bone, the upper part suddenly departing from the line of the middle part, and directing itself towards the trachea. The junction of the middle part with the uniform cartilage, frequently forms an angular projection. The ensiform cartilage may be almost horizontal, while the middle portion of the bone may be perpendicular, or inclining back as it rises. The author has seen this articulation form an elbow. These deviations have usually arisen in childhood while the articulations have been feeble, or the bones particularly pliant. Distortions may arise at other parts before the bone has acquired firmness or when the natural firmness is absent as in rachitis.

The weight of the head and superior extremities seems in cases of rachitis greatly to tend to deformities of the sternum, but as has been well shown by Dr. W. T. Gairdner in the

"Edinburgh Journal of Medical Science" for 1851, bronchitis and other chest diseases attended by dyspnœa are very frequent causes of the deviations from the natural form and position of the sternum as well as of the ribs. The author has seen several infants in whom great sinking of the ribs and elevation of the sternum have been in actual progress. The thorax along the course of the insertion of the diaphragm has been greatly depressed at every inspiration. In one remarkable example great dyspnœa was present, and after death the heart was found to be single and the pulmonary arteries taking their origin from the aorta. The chest goniometer is specially adapted for the measurement of these deviations.

Though phthisis and other diseases in the adult comparatively seldom give rise to alteration in the form of the sternum, they occasionally succeed in so doing. In some examples of phthisis, the author has seen the upper portion of the sternum manifestly drawn towards the trachea, when the action of the diaphragm has been forced, in consequence of more than usual dyspnœa. The same thing has been observed in severe chronic bronchitis, and in cases of long standing organic diseases of the heart. Cancers in the mediastinum when extensive, will raise the sternum and impart an undue roundness and prominence to it. Aneurism of the aorta produces a similar result.

The deviations of the sternum which it is desirous more particularly to point out here, are those which relate to its position. In phthisis the author has remarked that the sternum very frequently loses its position in the transverse plane of the body. In almost all examples of old cavities in the apices of the lungs attended with flattening, the sternum is found to have its transverse plane deviating from the transverse plane of the body. The edge of the sternum nearer the flattened cartilages and the cavity is directed backwards or to the interior of the chest. The sternum will be found to have rotated on that border which is nearer the sound side, to make in some cases an angular projection, and the transverse surface of the sternum, and the corresponding costal cartilages form one straight line. The depressed and retracted cartilages have succeeded in dragging the sternum with them.

This inclination of one border of the sternum to the interior of the chest usually holds with the bone throughout its whole length, but it may be more above than below, in which case the sternum acquires a somewhat twisted appearance.

But the deviation may not stop here. The sternum is not unfrequently at its upper part dragged over towards the cavity or the retracted side, and it thus loses its exact position in the

middle of the body. It pursues an oblique course, and when twisted as above described presents a very remarkable appearance, and one almost always conjoined with phthisis in the third stage or with extreme hepatization, but much more frequently with the former.

At the present moment there is a fine example of lateral deflection of the sternum under consideration in the Brompton Hospital under Dr. Cursham. The patient is a lad named Brown, of about 17 years, having a large cavity on one side. In the same ward Dr. Cursham has another patient, with this deviation less marked. The patient is a man of about 55 years, and he too has a cavity in the lung. The sternum is occasionally seen inclined towards the healthy side in cavity cases, dragged over by excessive expansion of the ribs.

Though the clavicles and scapulæ cannot strictly be said to form part of the thorax, it may not be without advantage to devote a few words to their behaviour in disease of the organs of the cavity of the thorax. The rising of these bones in cases of dyspnœa, emphysema, and empyema is very commonly known, but the lowering of them, though common too, is perhaps less attended to when proceeding from thoracic disease. In almost all examples of flattening, angularity, and retraction of the chest, these bones are the seat of deviations, greater or less, in their position. In single flattening these parts simply decline; the clavicle sinks as it proceeds outwards from the middle of the body. In cases of angularity where the ribs bend back abruptly, the clavicle frequently does the same, as ascertained either by the chest-goniometer; and the sterno-clavicular articulation is, as it were, laid open, and the finger may be partially introduced between the extremities of the two bones. The sterno-clavicular articulation of one side may be found much posterior to the other when the sternum at one border has inclined inwards. A boy is now under the author's care at the Brompton Hospital with a large cavity on the left side, whose left sterno-clavicular articulation is more than half an inch behind the other. In this case the fact attracts the more ready notice from the sterno-cleido-mastoideus of the right side standing out in consequence much more prominently than the other. The clavicle in this case, like the ribs, retires rapidly backwards.

VII. Lowering of the clavicle and scapula from descent of the upper ribs consequent upon contraction of the lungs is occasionally noted where there is comparatively little flattening in front; and where there is no curvature of the spine and no

reason to attribute the change to mere posture, it may assist in diagnosis. It is a weight, though a light one, to be employed in estimating the probabilities of internal disease.

VIII. Depression of the first and second intercostal spaces on one side is occasionally seen without the presence of any other deviation. The depression is seen most frequently near the sternum. It appears to be a preliminary to the more general flattening. In some examples of flattening and hollowing of the costal cartilages, the depression of the interspaces is very marked, and outstrips the other flattening. A young German named Koch in the Hospital, under Dr. Thompson, who has great flattening from a cavity, presents the interspaces remarkably hollow. They appear as if the thumb had been deeply pressed into them.

The influence of disease in producing deviations from the natural form of the chest has been fully shown by the foregoing facts, which seem to be sufficiently numerous for the purpose. They might have been greatly extended, though, it is believed, with no corresponding advantage.

There yet remain two points to be mentioned. The first is that phthisis in its third stage, though almost always associated with deviation from the natural form of the chest, is occasionally seen without any obvious deformity, and may be associated with actual prominence over the cavity. A very fine large woman in good condition came to the Hospital. The left subclavicular region was full and prominent, but to the surprise of the writer all the usual signs of a large cavity immediately beneath were discovered. Dull percussion, cavernous breathing and pectoriloquy were present. The explanation of this anomaly was found in a moderate curvature of the spine, which threw up the left shoulder and thrust forward the left side of the thoracic cone. The second point is this,—that deformities of the chest, such as have existed from childhood, do not appear to favour the advent of phthisis. Comparatively few of the many examples of long standing, or, so to speak, of infantine deformity of the chest, which have presented themselves to the author at the Hospital, have been associated with phthisis. The diseases more especially observed have been chronic bronchitis recurring at intervals, some dyspnœa usually persistent, and disordered action of the heart. The explanation of this fact is probably to be found in a comparative immunity from tubercular tendency, which has been proven by bronchitis and other diseases having arisen under circumstances which are perhaps calculated to induce tubercles in others. Dr. T. W. Gairdner

years ago proved that bronchitis and other diseases, not including phthisis, were the most frequent causes of the chronic deformities of the chest, and though these disorders may not exactly prove antagonistic to consumption, their presence and its absence rather argue a non-disposition to the production of tubercle, which probably holds in after life, and evinces itself in the fact now stated, viz., that comparatively few of the deformed chests presented at the Consumption Hospital are found to be associated with consumption,—at least, so far as the author's observations extend.

Table showing the proportions of each kind of deviation in 151 examples, with the respective numbers of each sex.

Flattening, both sides.		Flattening, one side.		Angularity, both sides.		Angularity, one side.		Preternatural Prominence, partial.		Total Males.	Total Females.	Total both sexes.
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.			
29	45	33	10	6	4	11	11	2	0	81	70	151

SOME OBSERVATIONS ON THE DIURETIC ACTION OF IODIDE OF POTASSIUM, WITH REMARKS.

By C. Handfield Jones, M.D., F.R.S.

Physician to St. Mary's Hospital.

It appears, *à priori*, no unreasonable expectation that the healing influence of a drug, in certain morbid states, may be shown to be explicable by its general mode of action. There are certainly cases we can point to, where the so-called specific action of a remedy may be shewn to be conformable with its physiological and general effects. For instance, quinine, in over-doses, causes deafness, or blindness, or even convulsions; and it is known to cure neuralgias; there are positive instances of its operation upon the cerebro-spinal nervous system; but it also cures agues and malarious fevers, or prevents them, a result which, on the theory of fever being produced by paralysis of the sympathetic nerve, falls into the same category as the preceding. The especial value of quinine is, that it raises and fortifies the tone or power of the whole nervous system, cerebro-spinal and sympathetic, and so obviates various morbid states which proceed from failure or derangement of its functional power. It is matter of great interest to remark that the same

effects, or similar, can be produced by influences operating through the mind, as are produced by quinine directly operating on the body. Many an ague has been cured by a strong mental impression; and many an attack of malarious disease has been prevented by the stimulus of mental excitement and animation. The effect of quinine on asthenic inflammation and fluxes is well known; and my friend, Dr. Sieveking, has communicated to me a case under his care, in which a male, suffering under hyperæsthesia and complete loss of tone, and passing daily Oiss to Oij of urine of sp. gr. 1030, containing an excess of urea, was greatly relieved in his general state by 10 grains of quinine *ter die*, while the specific gravity of the urine fell to 1010. Here we trace again the action of quinine on the nervous system, the cerebro-spinal and sympathetic, especially the portion of the latter constituting the renal plexus. In conformity with this is the analysis given under Case VI, where all the constituents of the urine examined were diminished in quantity. But there are certainly remedies which exert very positive curative influence, admitting of no doubt or question, yet which afford no clue in their general mode of action to explain their special effects. Such, it appears to me, is iodide of potassium. This drug has notoriously a strong controlling influence over periosteal inflammations, whether syphilitic or rheumatic, as well as over rupial ulcers, which heal under its use in a kindly manner. It is of more or less avail in inflammations affecting fibrous tissues in many different parts. It occasionally causes temporary catarrh. The subjoined analyses testify to its diuretic effect, though this is not quite constant. The details shew: 1. That the quantity of water was greatly increased in three out of six cases; a little (one-sixth) increased in one; diminished in two. 2. Out of five cases, the acidity was increased in three, diminished in two. 3. Urea was increased in three, diminished in three. 4. Phosphoric acid was increased in four, diminished in two. 5. Sulphuric acid was increased in four, diminished in two. 6. Chlorine was increased in three, diminished in two, out of five cases; in two the increase was very considerable. 7. Uric acid diminished in four out of six cases; greatly increased in the remaining two. The most marked effects seem to be the increase of the water, of the phosphoric and sulphuric acids, and of the chlorine.

But as far as these confessedly imperfect results go, there seems to be no help or clue afforded us to trace out any connexion between the empirical facts above noticed. A varying diuretic effect does not give any explanation to the *modus operandi* of the drug in curing a node or an ulcer. If an elimi-

nation of the poison be assumed, by which healthy nutritive action is allowed to take place, one can but remark that, in far too many of such cases, the poison remains in the system, and, sooner or later, reproduces the same, or similar mischief. The catarrhal and the diuretic effects of iodide of potassium might be viewed as actions of the like kind; viz., stimulating. But how shall we reconcile this with the removal of a node, or the cure of an ulcer, which resists local applications. For the present, I do not see that we can attain to more than an empirical acquaintance with the operation of this valuable remedy.

W. A., æt. 34, male, suffering under tubercular syphilitic eruption. April 7th, 8th. *Before* he had taken any potass. iod. the 24 hours' amount of urine was 37 oz., sp. gr. = 1013, clear.

Total acidity ..	=	13·536	grains of oxal.	acid.
Urea	=	324·564	„	„
Phosphoric acid	=	24·146	„	„
Sulphuric acid	=	16·132	„	„
Chlorine ..	=	35·434	„	„
Uric acid ..	=	2·701	„	„

April 12th, 13th. The 24 hours' amount of urine = 65 oz. sp. gr. = 1017, nearly clear. He had been taking, since 8th, potass. iodid., gr. xv. *indies.*

Total acidity ..	=	46·390	grains of oxalic	acid.
Urea ..	=	663·	„	„
Phosphoric acid	=	51·941	„	„
Sulphuric acid	=	35·035	„	„
Chlorine ..	=	125·931	„	„
Uric acid ..	=	6·175	„	„

Result.—The amount of acid is trebled, that of urea is doubled, of phosph. acid is doubled, as well as of sulph. acid; the amount of chlorine is more than trebled, and that of uric acid is more than doubled; quantity of water very much increased.

His diet was beef tea (1 pint), and ordinary, including meat, from March 31st to April 19th.

(2.) Mensey, æt. 29, male, suffering with rupial ulcers, has lately been mercurialized. No iod. potass. taken, yet passes, in 24 hours, 47 oz. of urine, sp. gr. 1017. May 17th.

Total acidity ..	=	5·734	grains of oxalic	acid.
Urea ..	=	460·224	„	„
Phosphoric acid	=	29·318	„	„
Sulphuric acid	=	24·744	„	„
Chlorine ..	=	84·600	„	„
Uric acid ..	=	11·28	„	„

Passed in 24 hours, May 25th, 38 oz. of urine, sp. gr. 1018, slightly turbid. Taking, since 17th, potass. iod., gr. ix. *ter die.*

Total acidity ..	=	18·536	grains of oxalic acid.	
Urea ..	=	395·352	„	„
Phosphoric acid	=	34·287	„	„
Sulphuric acid	=	25·957	„	„
Chlorine ..	=	64·079	„	„
Uric acid ..	=	7·60	„	„

He improved much by the treatment. Diet ordinary throughout.

Result.—The acidity is trebled; the urea, chlorine, and uric acid diminished; the phosphoric and sulphuric acids a little increased.

(3.) R. B., æt. 19. May 17th, recovering from destructive ulceration of penis. Quantity of urine in 24 hours, 43 oz.; sp. gr. 1017.

Total acidity ..	=	20·975	grains of oxalic acid.	
Urea ..	=	403·512	„	„
Phosphoric acid	=	33·032	„	„
Sulphuric acid	=	22·510	„	„
Chlorine ..	=	81·850	„	„
Uric acid ..	=	3·87	„	„

May 25th. Quantity of urine in 24 hours = 85 oz.; sp. gr. 1012, quite clear. Has taken, since 17th. potass. iodid., gr. vi., *indies.*

Total acidity ..	=	20·731	grains of oxalic acid.	
Urea ..	=	520·200	„	„
Phosphoric acid	=	27·599	„	„
Sulphuric acid	=	23·341	„	„
Chlorine ..	=	136·195	„	„
Uric acid ..	=	0	„	„

He improved much by the treatment. Diet ordinary throughout.

Result.—Acidity nearly the same; sulphuric acid ditto; urea much increased (more than a fourth); phosphoric acid somewhat diminished; chlorine greatly increased; uric acid much diminished. Quantity of water just doubled.

(4.) C. L., æt. 26, male; suffering under tertiary syphilis. June 8th, passes, in 24 hours, 37 oz. of urine; sp. gr. = 1022, turbid.

Total acidity ..	=	27·072	grains of oxalic acid.	
Urea ..	=	452·880	„	„
Phosphoric acid	=	25·626	„	„
Sulphuric acid	=	22·607	„	„
Chlorine ..	=	111·037	„	„
Uric acid ..	=	0·925	„	„

June 26th. Taking, since June 8th, potass. iodid., gr. ij–vi

ter die. 24 Hours' amount of urine = 74 oz.; sp. gr. 1011, clouded.

Total acidity ..	=	18·048 grains.
Urea ..	=	498·168 ,,
Phosphoric acid	=	35·127 ,,
Sulphuric acid	=	29·718 ,,
Chlorine ..	=	122·588 ,,
Uric acid ..	=	trace.

The determination of the degree of acidity of both these specimens is rendered less exact, from the circumstance that a day or two had elapsed from the time of passing the urine before I was able to analyse it.

Diet ordinary throughout. Improved much by the treatment.

Result.—Quantity of water greatly increased, and all the solids somewhat increased, except the uric acid. Acidity notably diminished.

(5.) Th., male, plumber, æt. 44. January 21st, suffering under increasing paralysis, of doubtful origin. At this date he had been taking pot. iodid., gr. xxx. *indies* for 10 days: iodine was readily detected in his urine. Quantity of urine in 24 hours = 50 oz., sp. gr. 1023.

Total urea ..	=	528·750 grains.
Phosphoric acid	=	62·970 ,,
Sulphuric acid	=	36·670 ,,
Uric acid ..	=	13·50 ,,

No beneficial or injurious effect was produced by the iodide. January 27th, he was passing, in 24 hours, 62 oz. of urine, sp. gr. 1013. No pot. iodid. had been taken since 21st (there was no iodine in the urine) but instead, strychnine, gr. $\frac{1}{20}$, Tr. arnicæ, ♏ xv, aquæ ℥ss. *ter die.*

Total urea ..	=	604·50 grains.
Phosphoric acid	=	30·962 ,,
Sulphuric acid	=	39·487 ,,
Uric acid ..	=	0· ,,

No material alteration of diet had been made.

The strychnine and arnica can scarcely be thought to have had any influence on the excretion of urine. In an experiment upon a healthy male, strychnine alone, in the same dose as above, had no decided effect.

Result.—The quantity of urine was greater when no pot. iod. was taken; the urea and the sulphuric acid were also in larger amount at the same time, while the phosph. acid and the uric acid were in far larger amount during the iodine period than afterwards.

(6.) E. G., æt. 39, male. February 3d, weather snowy, cold. Quantity of urine passed in 24 hours = 32 oz., sp. gr. = 1028·5.

Total urea ..	=	588·0 grains.
Acidity ..	=	22·860 grains of oxalic acid.
Phosphoric acid	=	48·892 „
Sulphuric acid	=	38·313 „
Chlorine ..	=	75·456 „
Uric acid ..	=	10·24 „

February 8th, 9th. Cold east wind. Potass. iodid., gr. x, taken in 5 doses, in 29 hours. It caused a notable degree of languor. Quantity of urine in 24 hours = $38\frac{1}{2}$ oz., sp. gr. = 1020; iodine was detected in it.

Total urea ..	=	418·687 grains.
Acidity ..	=	19·250 grains of oxalic acid.
Phosphoric acid	=	48·009 „
Sulphuric acid	=	35·489 „
Chlorine ..	=	62·755 „
Uric acid ..	=	7·623 „

Diet not altered.

Result.—Quantity of water increased (one-sixth); of urea, and all the other ingredients, more or less diminished.

With the above may be compared another observation, made on the same person, February 15th, during a cold, damp, east wind, when quin. disulph., 10 grains, were taken in 48 hours—8 grains in the last 9 hours. The urine was collected up to about 6 hours after the last dose. Whole quantity in 24 hours $32\frac{1}{2}$ oz., clear; sp. gr. = 1022, of light amber colour.

Total urea ..	=	511·875 grains.
Acidity ..	=	12·609 grains of oxalic acid-
Phosphoric acid	=	38·740 „
Sulphuric acid	=	35·587 „
Chlorine	=	50·537 „
Uric acid ..	=	5·037 „

Result.—This observation shows the quantity of urine almost exactly the same as when no medicine was taken, but almost all the ingredients diminished to a greater or less extent, the acidity and the uric acid especially. This latter particular accords with the observations of Dr. Ranke.

(7.) E. H., female, æt. 27: has slight jaundice, rheumatic fever, and a syphilitic sore on labia. Took, from March 27th to April 12th, potass. bicarb., ℈ij *alt. horis.* The rheumatism being then much diminished, she began to take pot. iodid., gr. viij. Decoct. Sarzæ, ℥ij *ter die.* April 1st: urine of 24 hours = 32 oz., very high coloured, sp. gr. 1027. April 5th, urine of 24 hours = 46 oz., sp. gr. 1016, alkaline, clear. April 16th: urine of 24 hours = 20 oz., sp. gr. 1021, high coloured;

at this last date she was quite convalescent. This observation shows that the secretion of urine may be much less under the use of iodide of potassium than under the free use of alkalies: its amount was even less than it would normally have been; at the same time the sp. gr. does not indicate any unusual relative amount of solids.

CASES OF CALCAREOUS DEPOSIT IN THE SUBSTANCE OF THE BRAIN-

By John W. Ogle, M.D., F.R.C.P.
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Case II.

Epilepsy.—*Hemiplegia on the* Left *Side, preceded by Vomiting, Rigors and Pain in the Limbs.—Remarkable Freedom from Pain in the Head.—Softening of the Central and Extensive Calcareous Deposits in the Cortical Portions of the* Right *Cerebral Hemisphere.—Fibrinous Concretions on the Mitral Valve Flaps, and in the Substance of the Spleen.*

THE Patient was a young woman, aged 28, who died in St. George's Hospital.

Previous History.—She had apparently enjoyed general good health until about five months before her admission into the hospital, when she began to suffer from pain in the loins and great general debility. At this time also the catamenia entirely ceased. About two months later her legs began to swell, and blood was found in the urine. She also became frequently troubled with nausea and vomiting.

Symptoms on Admission.—When admitted her face was pallid and puffy, and the urine, specific gravity of which was 1017, contained blood and numerous fibrinous casts, as also much epithelium from the surface of the bladder and renal tubes. The tongue was clean, and the bowels regular.

Course of the Disease.—In a few days febrile symptoms set in with some intensity, and rigors, with considerable pain in the arms and legs, were complained of. Subsequently the pain was more especially referred to the left side of the body. Twelve days after admission, during the night, and after complaining of unusual chilliness, she completely lost the power of motion of common sensation down the whole of the left side; and on the following morning she was found in a half comatose condition. She could, however, be roused, and when asked the question she persisted in saying that she suffered no pain whatever in the head. Whether she had had any convulsive seizure during the night could not be positively ascertained; but if so, it could not have been a very aggravated one, as

then most likely the nurse or surrounding patients would have perceived it. Her pupils were both very dilated and quite inactive under the impression of light. The tongue protruded, was pushed to the *left* side. The evacuations were passed involuntarily, but after awhile she entirely gained her consciousness, although she was occasionally affected with drowsiness. For about 19 days she remained in very much the same condition, never complaining of pain or uneasiness of any description, and gradually she regained some degree of power of movement in the affected leg, and could feel pain whenever the surface of the leg was pinched. She also obtained command over the sphincters of the bowel and bladder. The urine became very freely passed, but was of very low specific gravity, varying from 1002 to 1008. In a short time bad sores began to form, and the paralysed arm became highly œdematous. During one night she was suddenly seized with two violent general convulsive attacks, which were followed by complete loss of power in the left side, and by a remarkable immobility of both eyeballs.

She gradually lost strength, and was again during the night seized with an epileptic attack and died on the day following.

The *Treatment* resorted to consisted in the first instance of the use of buchu and nitrate of potash. When the "fits" came on, purgatives and stimulants, with the abstraction of a small amount of blood from the temples, were resorted to; but during most part of her time in the hospital, tonics and stimulants and opiates were relied upon.

Post-mortem Examination.—*Thoracic Organs.*—A few adhesions were found in the pleural cavities, and both lungs were highly congested. Moreover, the left lung was much "hepatized" at its lower part. The walls of the left ventricle of the heart were much thickened, and a large quantity of fibrinous deposit existed in connection with the margins and surface of the mitral valve flaps. Much of this was arranged in pendulous masses, and all was easily dislodged with the finger. Extensive pericardial adhesions also existed.

Abdominal Organs.—The kidneys were large, and very congested and mottled; and the spleen had a largeish block of firm yellow fibrin occupying part of its substance. The other viscera were natural.

Cranium.—The integuments covering the cranium, as well as the bones of the head, were in all respects natural. The cerebral membranes were also natural. The left cerebral hemisphere, as well as the cerebellum, were quite healthy in their structure, but a large portion of the central part of the opposite (the right) hemisphere was in a very softened broken-down condition. On examining the cortical part of this hemisphere, the lateral portion corresponding to the softened part just described was found to contain a large mass, *two inches in length,* of calcareous matter. The gray substance of the brain immediately around this was not softened, or in any way perceptibly altered.

Two other, but smaller, portions of similar calcareous substance were found also in the cortical part of this hemisphere at a more anterior and inferior part of the organ, and a slight amount of calcareous deposit also existed in the superficial part of the right corpus striatum. The cranial sinuses and cerebral arteries presented nothing unusual.

Remarks.—I will now draw attention to a few points of interest in connection with the above Case No. II., and also Case I., detailed at page 81 of the preceding number of the "Archives."

Although in both cases we have well marked instances of the deposition of calcareous matter in the substance of the brain itself, apart from any connection with the cerebral membranes, yet the deposit in these two cases existed under very different circumstances. It will be, I think, acknowledged that the

presence of bony or calcareous matter,* under any circumstances, in the brain tissue, is very rarely met with. In systematic works such a deposit is at times alluded to in the general description of tumours of the brain, but in very few instances are such cases specified. Abercrombie, indeed, alludes to the mention by Van Swieten of a case in which an irregular piece of bone, an inch long and half an inch broad, existed in the substance of the cerebellum; but I do not meet with any authors adducing similar instances.† Considering the peculiar chemical characteristics of brain matter, we might perhaps be led to expect that phosphate of lime concretions were produced more frequently in that tissue under certain forms of disease. This does not, however, appear so to be, and the above two cases are the only ones of which our post-mortem records at St. George's Hospital furnish us with any details.

Of these two cases, which, as I before said, differ very materially in their general circumstances, No. I. is, I believe, an instance of the presence of calcareous matter, owing to the metamorphosis of scrofulous matter. This appears to be so from the history of the patient, the presence of scrofulous deposit in other organs of the body, and from the actual existence of soft yellow material, having the characters of scrofulous material, acting along with fibrous cicatrix-like tissue as a bond of connection between the calcareous matter in question and the pia mater. It is well known that calcareous changes frequently occur in scrofulous matter deposited in other regions of the body, as in the lungs, bronchial and mesenteric glands, &c.; and I incline to the supposition that the reason why scrofulous matter in the brain showing any calcareous change is so seldom met with, is that so delicate and vital an organ as the brain, as a rule, too quickly resents the presence of scrofulous matter, and that the consequences of its deposition tend to produce death before it has had time to undergo calcareous transformation. This opinion as to the nature of the calcareous matter in this case receives negative support from the total absence of hydatid formation, or of blood-clot, or of ordinary fibrinous exudation, under any of which circumstances calcareous degeneration is wont to occur. We may, no doubt, infer that the scrofulous matter had existed in the brain for some time in this instance.

I will, in passing, allude to the extreme tenuity of the

* In neither of the two cases just brought forward was any true bone-structure found in the calcareous matter.

† Of course I make no reference to those cases, which are much more frequent, in which calcareous and true bone-growths are found in connection with various parts of the dura mater.

cranial bones, which were in Case I. so thinned as to be almost uniformly translucent. This state of the bones of the head I have more than once met with in cases of scrofulous deposit within the cranium.

As regards the *Symptoms* in this case, No. I., the softening of the brain immediately around the calcareous matter, and the loss of true structure, as shown by the microscope, was, without doubt, the cause of the cerebral disturbance, viz., the head-ache chiefly on the left side, the mental illusions, &c., (the gray matter being extensively affected). Of interest it is to note the convulsive action, showing itself mainly on the right side of the body (the disease existing in the left side of the brain), as also the subjective sensation of chilliness, and the pain in the right arm and leg, and the swelling of the throat on the right side, the letter symptom, no doubt, being owing to contraction of the muscles in that region. The tongue, which had hitherto been protruded in a direct line, was on one occasion (May 14) found to be always protruded to the left, and at the same time the mouth, which had not heretofore been affected (there having been no facial paralysis, &c.,) was drawn to the right. These varieties in the symptoms took place not long before death, and followed two very strong convulsive attacks, and were, doubtless owing to some paralysis, involving also the left side of the body, in addition to the pre-existing loss of power on the right. It is, however, just possible that the drawing of the mouth to the right was a positive result of supervening spasm of the muscles of the right cheek, and the supposed protrusion of the tongue to the other side merely apparent. It is also worthy of observation that although much head-ache was complained of, no vomiting was ever noticed; and a very interesting and unusual symptom was the stuttering, in addition to the deficiency in power, of right pronunciation. Thus much for Case I.*

Respective of Case II. there are also several points worthy of special interest. I will enumerate them.

First of all regarding the calcareous matter. This evidently existed in the brain under relations totally different to those connected with the calcareous matter in Case I. In that case it appeared certain that this deposit was owing to ulterior changes in scrofulous matter. It did not appear to be so in Case II. No scrofulous matter in this case existed in any other

* I take this opportunity of stating that in the history of the microscopical examination of the brain in Case I. I omitted to say that the description of disintegrated brain merely referred to the structure in the immediate neighbourhood of the deposit.

part of the body, and in the brain nothing of the kind was associated with the calcareous matter, as in the former instance. The calcareous matter was evidently of extremely old standing, and seeing that it was immediately surrounded by healthy brain, we may assume that it is so gradually accumulated as to have had, in itself, no injurious effects.

As to the method of its origin it is most probable that it was the result of conversion of fibrinous material of cachetic or other extraction, or of old blood-clots which had been exuded at some period. Certainly no discolouration or other traces of extravasated blood were found around, but such indications are not unfrequently absent after many years, and, and is easy to suppose that whether fibrinous exudation or blood extravasation have been concerned, the whole might undergo change, and thus no remains be met with unconverted. We have a good instance of such a fact in the phlebolithes, so called, in which it is obvious that large masses of blood-clot or fibrin have wholly been transformed not only into calcareous but also bony matter.* As regards the softening of the brain, the lesion which no doubt caused the convulsive action and death, it is not likely that it was in any way dependent upon the presence of the calcareous matter. Most likely it was secondary to loss of nutrition, caused by the blocking up of some minute arterial branch by fibrin dislodged from the heart's valve, borne onwards by the blood. (See the description of the loose pendulous deposit on the mitral valve flaps). It is true that no plug was seen in any of the vessels; but if in a very small vessel such might, and no doubt does, very frequently pass unobserved; and it seems likely that a very slight degree of obstruction to circulation in the case of such an organ as the brain will lead to extensive destruction.

As regards the symptoms in this the second case, we have to notice the entire freedom from head-ache and vomiting, a contrast in this respect to case the first, in which the cortical part of the brain (in the present case uninjured) was extensively softened. The rigors, the general pain subsequently localised in the side subsequently paralysed, and the pain in the paralysed limbs at a later period, are all subjects of interest in a clinical point of view. We have also the history of more lethargy and coma, but of less convulsive action, set up in this case than in the former one (Case I.); and these differences, in addition to

* In a case published by myself in vol. 7 of the "Transactions of the Pathological Society," p. 133, of a phlebolithe from the iliac vein, measuring two inches in length, and of considerable thickness.

others, may be attributed as well to the fact that different parts of the brain, medullary as well as cortical, were affected in each case respectively, as to the fact that no doubt the lesion in Case II. was much more sudden in its appearance and more recent than in Case I.

In the second case the destruction of brain was apparently atrophic in character, whilst in the first case it was due to irritation, caused by scrofulous matter deposited in the part.

As regards the nature of the cardiac affection, one of the links in the causation of death, there seems to be no reason for supposing it to be rheumatic in origin; and the pains in the limbs, as their character would seem to indicate, and as illustrated by the lesion found in the brain, were referable to changes in the nervous centres.

The precipitation of fibrin on the heart's valves, as well as the presence of a large fibrinous mass in the texture of the spleen point, however, to a general constitutional tendency, probably not unlike that which does obtain in rheumatism.*

CASE OF PARALYSIS ACCOMPANIED BY INCREASED SENSIBILITY, CONSEQUENT UPON DISEASE OF THE SPINAL COLUMN.

By Henry Lee,
Surgeon to King's College and the Lock Hospitals.

THE following case derives its interest from the light recently thrown upon the pathology of the spinal chord by M. Brown-Sèquard.

James Holmes, of a ruddy complexion, with blue eyes and dilated pupils, was admitted, much emaciated, into St. George's Hospital, on the 14th of February 1838.

Three years previously he had received a severe blow upon the loins from a piece of timber. Six months after the accident he became subject to occasional pain in the loins, which was not very severe, and lasted for some four or five weeks at a

* The two specimens described in the above Cases I. and II. may be seen in St. George's Hospital Museum, as Numbers 1 and 2, c., Subseries iv., Series xx.

time: for as many months he would then be comparatively easy. He suffered most when he attempted to raise himself from a stooping position. Six months before his admission into the hospital, the symptoms became much more severe, and a swelling appeared in the loins, upon the left side. The pain now subsided, and he continued to walk about, but after doing so he experienced a sense of fatigue in the loins. The swelling gradually increased—became ultimately as large as a child's head—and burst, as he was walking in the street. Three weeks after the bursting of the abscess he was seized with great pain, extending from the hip to the bottom of the foot, on the left side; and this ocasionally recurred until his admission into the hospital. About the same period that he first experienced this particular symptom, he lost the power of moving his left leg. Sensation was unaffected, except in the thigh,—and here the least touch would cause very acute pain. The *peculiar symptom of increased sensibility was entirely confined to the thigh.* Neither motion nor sensation were affected upon the right side. Pressure or percussion on the bottom of the foot, or over the trochanter of the paralysed limb, or moving the limb, gave no uneasiness.

On the 17th of February an abscess on the upper part of the left thigh was opened; and on the 15th of March a similar abscess was opened on the right side, and he died on the 18th of April. He had regained the use of the left leg in a great measure since the middle of February preceding.

On a post-mortem examination, the intervertebral cartilage, between the third and fourth lumbar vertebræ, was softer than natural, and ulcerated on its surface: a smooth depression was thus formed, as if a portion of the cartilage had been gouged out with an instrument. The adjacent surfaces of the two corresponding vertebræ were similarly ulcerated, for a distance of three or four lines; the bone beyond was of its natural consistency. The spinal cord was, unfortunately, not examined.

The occurrence of increased sensibility in the lower or hinder extremities, when one-half only of the spinal chord has been injured, M. Brown-Sèquard has shown to be of ordinary occurrence; but he has also shown that the conductors of sensation are scattered generally through the spinal chord, and not confined to any one part of it; and he has proved by experiment that when sensation is thus influenced, the whole of the lower or hinder limb is affected, and that every part is involved in an equal degree. Now, in the preceding case, as the increased sensibility was confined to one part, it follows that it did not depend upon any affection of the spinal chord itself. It must

therefore have been produced by a disease of the roots of the spinal nerves, below their origin. This view is confirmed by the original affection of the spinal column having been situated below the point to which the spinal chord extends. It therefore appears that loss of power, dependent upon a disease of the anterior roots of the spinal nerves, is liable to be accompanied by increased sensibility of the parts to which those nerves are distributed, in the same way as increased sensibility on the same side, is the ordinary result of a disease or injury of one-half of the spinal chord.

CASE OF POISONING BY CHLORIDE OF ZINC—DEATH IN LESS THAN EIGHT HOURS.

By G. R. CUBITT, Esq., Stroud.

H. V. L., æt. 56, cloth-worker, residing at Stroud, a short, fat, thickset man, with incipient *arcus senilis*, of somewhat free-living habits, for some few years subject to winter catarrh.

On the morning of September 6th, 1858, in consequence of a slight febrile attack, with derangement of the stomach and bowels, received a common febrifuge mixture, containing ammonia and nitre. He was out of work, and during the subsequent part of the day took, perhaps freely, of both beer and rum, but upon returning home went to bed perfectly sober.

The following day, September 7th, at 5.40, a. m., immediately upon getting out of bed, he took, in mistake for his medicine, upon a perfectly empty stomach, two table-spoonfuls of "Morell's solution of chloride of zinc." He was not made aware of his mistake by any difficulty in swallowing the liquid, or by any violently corrosive action upon the mouth or throat, but simply by the peculiarity of its flavour. He alarmed the people in the house, who speedily gave him a mustard emetic.

At about 6.30, a.m., I found him partially dressed, sitting up, and vomiting,—his pupils contracted to the size of a pin's head, his face flushed, forehead bathed in sweat, the general surface warm, and the pulse soft, and about 80. The bowels had been relieved of several loose watery evacuations. He was complaining of severe, but not agonising pain at the pit of the stomach,

with a sense of distension: there were no marks of corrosive action about the mouth or fauces. The epigastric pain extended into the right hypochondrium, and was somewhat increased by pressure. There was no flatulent distension of either stomach or bowels; a little urine had been passed: no traces of blood in the matters evacuated by vomiting or at stool.

Full and free vomiting, to the amount of many pints, was induced by olive oil, large quantities of magnesia suspended in tepid water, and subsequently by simple diluents. In a little while the pain and distension were increased; but after vomiting the original suffering seemed diminished by the treatment. During its operation a small quantity of urine was passed, and a scanty stool, resembling dirty water, and without fœcal odour.

At 8.15, a.m., the pain which had latterly increased, and had extended towards the umbilicus, had become intolerable, and it was difficult to keep the patient in bed,—it had been accompanied with severe cramp in the lower extremities. The vomiting continued; no abdominal distension; no increase of tenderness; the tongue was a little coated, and he was beginning to complain of thirst. The pulse was not materially influenced,—it was soft, and a little quickened.

With a view to anticipate inflammatory action, should time be afforded for its establishment, the abdomen was covered with a mustard cataplasm; and when the surface was well reddened a dozen leeches were applied, and followed by a warm poultice. At the same time 2 gr. of solid opium were given, and $\frac{1}{2}$ gr. every subsequent half-hour. The leech bites bled well, the blood being of its natural florid colour.

At 10.30 the pain was much diminished—no complaint being made except upon inquiry; but the vomiting continued, and the pulse was sinking rapidly, becoming more weak and frequent; the tongue was getting dry, and the thirst had become distressing; the extremities were cold, the pupil dilating: jactitation and restlessness. The stomach could retain nothing, so that the treatment resolved itself into frictions, and the application of warmth to the extremities.

At 12.30 the collapse had become extreme, but there was little or no complaint of pain; the face and extremities were purpled, and the voice thick and husky, and subsiding into a hoarse whisper; the respiration was easy, and the breath warm; the heart's action quite imperceptible, both at the wrist and cardiac region,—yet the state of things was more like that of a cholera patient than of one in syncope. The intellectual faculties were perfectly and indeed wonderfully clear: though aware of his condition, there was no alarm, and the face was not

indicative of either suffering or anxiety. The pupils were largely dilated, and he complained of being unable to see distinctly.

At 1.30, being 7 hours and 40 minutes after taking the poison, he died, without a spasm or struggle of any kind, retaining his consciousness to the last.

Autopsy, 21 hours after Death.—Rigor mortis slight; no decomposition; no abdominal distension.

Stomach and bowels contained a small quantity of the matters administered during the treatment.

Mouth and fauces free from corrosive action; œsophagus lined with an abundant tenacious mucus, the surface beneath being natural, or at most but very slightly reddened. The lining membrane of the stomach was covered with a similar mucus, and in the cardiac two-thirds of the organ was very much softened and disintegrated, so as in many places to peel off with the mucus; indeed in some places it was difficult to say which was secretion and which the membrane. In the pyloric region, and especially at the pylorus itself, the mucous membrane was toughened and condensed, extremely corrugated, and of a dull yellowish buff colour, not unlike a much used piece of wash leather which had been hung in the sun to dry; indeed the chloride seemed to have entered into chemical combination with it, so as to form a new tissue. The same appearances extended to a less degree into the commencement of the duodenum, and further on were replaced by those described as found in the cardiac region of the stomach, these again gradually subsiding till all below the commencing jejunum was tolerably natural. Such portions of the stomach and intestinal canal as were unusually soft were found by transmitted light to be also unusually reddened. The rest of the abdominal viscera were healthy, and the bladder empty.

The cellular tissue was everywhere loaded with fat.

There was a great accumulation of the same material about the heart, the muscular tissue of which suggested the idea of fatty degeneration; the heart itself was somewhat hypertrophied, and all its cavities were distended with uncoagulated diffluent blood. The right lung presented very extensive, but old, pleuritic adhesions, and also the evidence of recent and limited pleurisy in the shape of some six ounces of serum and of newly effused lymph, disposed in honeycomb fashion upon costal and visceral pleura, bands of the same material passing through the fluid from one reflection of the pleura to the other,—though recent, it was evidently prior to the poisoning.

The head and spine were not examined.

It will hardly fail to have been observed that the above case,

though presenting a well-marked illustration of the effects of a poisonous dose of chloride of zinc upon the animal economy during life, and upon the tissues, as observed after death, cannot be accepted as a fair measure of its violence in ordinary cases. The patient was a peculiarly unfortunate subject for such an accident: his irregular habits, the history of his previous illnesses, the incipient *arcus senilis*—all marked him out beforehand as ill-constituted to contend against any nervous shock; while the serious disease of lungs, and the tendency to fatty degeneration of the tissues, as disclosed after death, will in themselves sufficiently explain the fact of his having so readily succumbed to it. It is possible he might yet have escaped, had the poison met with any food in the stomach, to diminish the violence of its local action upon the coats of that organ, or to delay its absorption. How far the fatal issue may be attributable to that local action, how much to this absorption into the circulation, is a fair subject for inquiry. The extensive changes in the tissues of the stomach in a comparatively short time, and the absence of all inflammatory action, would seem to favour the idea that the nervous shock which followed was the direct consequence of violence done to a vital organ most intimately associated with the organic nervous centres. On the other hand, when we consider the phenomena in their order of sequence, we can hardly escape from the conclusion that we are dealing with an agent which has been absorbed into the circulation. Thus, the shock did not immediately follow upon the reception of the poison; on the contrary, a very appreciable interval elapsed before any symptoms of depression appeared at all, and when they did appear, their development was not instantaneous, but gradual, progressive, and culminating. The cramps in the voluntary muscles, taken alone, may be attributed either to absorption or to sympathetic irritation; but the latter would scarcely account for the watery and otherwise unnatural evacuations that accompanied them, and which looked more like an effort of nature to excrete an irritant poison from the circulation. But be this as it may, it is interesting to remark the concentration of the poison upon the nervous system of organic life. Nothing could be more clear and undisturbed than was his intellect up to the very moment of death; in this respect, and in some others,—as the cramp in the voluntary muscles, the coldness and want of pulse at the extremities, the purple hue of these parts, the change of voice,—the case presented a striking analogy to one of cholera; and this analogy becomes the stonger when we remember that the points of contrast are exactly those which are easily explicable by the absence of the

excessive discharges common in that disease. It is, further, interesting to remark the almost entire escape of the fauces and œsophagus from corrosive action, which would scarcely have been anticipated; and also the uncoagulated character of the blood, distending the cavities of the heart.

LARGE FLAKE OF THE EPITHELIAL COAT OF THE STOMACH VOMITED BY A PATIENT SUFFERING FROM SCARLATINA,—DEATH.

THE portion rejected was about the size of the palm of the hand. It evidently consisted of the epithelial coat of the stomach. The rugæ were very distinct in every part, and under the microscope only epithelial cells and mucus could be detected. There were many smaller shreds of the same nature rejected at the same time. At the post-mortem examination the walls of the stomach, at the cardiac extremity, especially in the upper part, were found to be very thin; and it was probably from this situation that the epithelium had been stripped off. The mucous membrane was much injected, and covered with a very thin epithelial layer. Partial reparation of the lesion had therefore taken place, as would have been expected, since the patient lived three days after vomiting the mass above referred to. The epithelial layer, and a portion of the coats of the stomach, have been preserved.

The following notes of the case have been furnished by Mr. Cayley, Assistant House Physician.—[Editor.]

Case.—M. K., aged 24, admitted into King's College Hospital, August 20th, under Dr. Beale, who was attending for Dr. Todd. The patient "had latterly been employed in the ward in which there were two cases of scarlatina, both slight ones. Previously to her present illness she had always enjoyed excellent health. On August 19th she felt feverish, and generally ill.

August 20th.—This morning she complained of headache and sore throat, and vomited occasionally. Her face, chest, and arms were completely covered with the rash of scarlatina. The tonsils, pharynx, aud palate were of a deep red colour, and the tonsils much enlarged; skin hot and dry; appetite bad; bowels freely open; P. 108, R. 24.

Ordered milk diet, strong beef tea Oij, two eggs.

℞ Sp. Æth. Chlor.	♏x
Ammon. sesqui carb.	gr. v.
Liq. ammon. acetat.	ʒ iij.
Mist. acaciæ	℥ iss.

Every four hours.

August 21*st.*—Was very much purged during the night, and vomited several times; the vomiting being immediately excited by the beef tea. During the night she took ℥iij of brandy. This morning she complained of pain and tenderness over the epigastrium, the pain being increased by food. Her throat was more painful, and the left tonsil was ulcerated. The rash had spread over the whole body, and the conjunctivæ were inflamed; P. 120, feebler; R. 24; urine not albuminous.

Ordered an extra pint of milk, instead of the beef tea, and ℥ss. of brandy every two hours.

Throat to be touched with nitrate of silver.

℞ Sp. ammon. aromat.	ʒj.
Tinct.krameriæ	ʒss.
Decoct. Hæmatox	℥iss.

Every four hours.

Evening.—The vomiting and purging had continued during the day, and she had kept down neither food nor medicine; she was very restless, and a little delirious; pulse 122, feeble.

Ordered brandy ℥ss every hour, to be taken iced.

℞ Acid. hydrocyan dil	♏iij.
Mist. effervescens.	℥j.

Every four hours.

R. Tinct. opii	♏x.
Decoct. amyli	℥j.

For an enema.

Liq. morphiæ. hydrochlor...	♏xx.
„ Aq.	℥j.

To be taken at bedtime.

22*nd.*—The bowels had not been opened since the administration of the enema. She still vomited occasionally after taking her food, but retained the brandy. She slept pretty well, but seemed weaker this morning. The eruption continued out over the whole body, and the throat was more ulcerated: P. 134, R. 36.

23*rd.*—She continued to vomit occasionally during yesterday afternoon, and in the night, but did not reject the iced brandy. In the night she slept badly, and was delirious. This morning, about 7 a.m., she vomited up with some bile, a piece of the epithelial coat of the stomach, about the size of the palm of the hand. Since this time the pain and tenderness of the stomach increased, and she vomited every thing she took. P. 134, R. 36.

Ordered to leave off her medicine, and to have neither food nor brandy administered by the mouth. Repeat the opiate enema, and in half an hour the following enema, to be repeated every four hours.

Disulphate of quinine	gr. x.
Brandy	℥ iss.
Strong beef tea	O ss.

℞ Pulv. opii, gr. ½, in the form of a pill, to be taken every four hours.

Evening.—She retained the enemata, and had not vomited again. She continued to complain of pain in the epigastrium, where there was great tenderness on pressure. She was very restless, and wandered a good deal. P. 130.

24*th.*—She slept a little during the night, and retained the enemata. There was less pain and tenderness in the epigastrium. She complained much of thirst, and wandered a little. The eruption was fading from the face. Urine natural. P. 114.

To continue the enemata with ♏x of laudanum added to each, every three hours, and to take a little weak iced brandy and water during the day.

25th.—She was very delirious during the night, and got no sleep. There was less tenderness in the epigastrium, and she did not complain of pain after taking the brandy and water. At about 7 a. m., 2½ hours after having an enema, she had a very profuse evacuation, consisting partly of the altered enema and partly of very fetid feculent matter. Her pupils were much contracted, and she was very deaf. P. 108. Ordered to continue the enemata, and to take some bread and milk, and ʒij of brandy every hour.

Evening.—She continued much in the same state all day, and retained the bread and milk and brandy. At night she was very delirious, and tried to get out of bed repeatedly. Pupils extremely contracted. P. 120, feeble, Ordered to continue the laudanum in the enemata.

26th.—She got no sleep during the night, and continued very delirious; towards morning she got much weaker; and when seen at 9 a. m. was in a state of low muttering delirium; picking at the bedclothes. P. 124, very feeble. She now had brandy given her every five minutes, but gradually sank, and died at 4, p. m.

Post-mortem, 24 hours after Death.—The lungs, liver, and kidneys were much congested; the other abdominal and thoracic organs appeared healthy, with the exception of the stomach. The mucous membrane of the stomach and duodenum were much congested, but there was no extravasation of blood in any part. The muscular coat, towards the pyloric extremity, was firmly contracted, and the mucous membrane thrown into rugæ; but the cardiac portion was relaxed, and the coats in this region seemed very thin; the mucous membrane was not thrown into rugæ.

ORIGINAL RESEARCHES IN PHYSIOLOGY AND MORBID ANATOMY.

ON THE ANATOMY OF THE SPINAL CHORD.

By Lockhart Clarke, F.R.S.

PLATES XX. AND XXI.

It has been long known that the spinal chord consists externally of white columns, and internally of grey substance, and that it is divided by the anterior and posterior median fissures into two lateral and symmetrical halves, in each of which the white or external portion is again divided into a posterior and an antero-lateral column, by means of the posterior-lateral fissure, through which some of the posterior roots of the nerves reach the grey substance.

Structure of the White Columns.—These consist of—

1. Transverse, oblique, and logitudinal fibres.
2. Blood-vessels and connective or areolar tissue.

1. The *transverse* fibres are of variable breadth, but the

majority have small diameters. They proceed from the grey substance, and form with each other a kind of plexus between bundles of the longitudinal fibres, with which many are seen to be continuous, while others reach the surface of the chord, through fissures containing connective tissue. Within the grey substance from which they radiate they are continuous with (*a*) the roots of the nerves, (*b*) the processes of the cells, and (*c*) the anterior and posterior commissures. *The oblique* fibres proceed also from the grey substance, both upwards and downwards; they form the deep strata of the white columns, and after running for a variable length, become longitudinal. The *longitudinal* fibres are more superficial; they form the greater portion of the white columns, and run nearly parallel with each other.

2. The connective tissue consists of a fine network between the fibres and blood-vessels of the columns. In delicate preparations of the spinal chord of the calf, this tissue is seen to be everywhere interspersed with a multitude of minute cells or nuclei, which send out processes or fibres in different directions, to assist in forming the network.

Structure of the Grey Substance of the Spinal Chord.—This consists of—

1. Nerve-fibres. 2. Nerve-cells. 3. Blood-vessels and connective or areolar tissues.

1. The nerve-fibres are all *tubular,* but vary considerably in breadth; the larger kind only have double contours, and are most abundant in the anterior cornua. They cross each other in a great variety of ways, both in the same and in different planes, frequently changing their course from transverse to oblique or longitudinal, once and sometimes twice. In some parts they run in separate longitudinal bundles, as will be seen further on.

2. The nerve-cells vary much, both in shape and size. They are round, oval, fusiform, pyriform, crescentic, triangular, stellate, or otherwise irregular, and have from at least two to eight processes, which extend in different directions—transversely, obliquely, and longitudinally—and form part of the longitudinal bundles, the commissures and the roots of the nerves.

3. The connective or areolar tissue of the grey substance is finer than that of the white columns, but is continuous through it with the pia mater of the chord.

Form of the Grey Substance.—At the lower part of the conus medullaris or conical extremity of the chord, the posterior grey substance forms but a single broad mass. (*See* Plate XX., figs. 1 and 2.) Behind, and for some distance on each side, it consists of a lamina or band, which is softer, paler, more transparent, and

known as the *gelatinous substance.* (*See* g, Plate XX., fig. 2.) The anterior grey substance, on the contrary, as in other regions of the chord, is separated, by the anterior fissure and white columns, into two distinct portions—the anterior cornua, from each of which, near its base, a number of fibres cross over at the bottom of the anterior fissure, to decussate with corresponding fibres from the opposite side, and so form the anterior commissure. In ascending towards the lumbar enlargement, the posterior grey substance, like the anterior, becomes gradually divided in the middle line into two lateral portions or cornua, which continue to increase in depth until they are joined only at their bases by a narrow band of transverse fibres called the posterior commissure. (Plate XX, fig. 3.) Between this and the anterior commissure is the central canal, *f*. This canal is larger in diameter in the conus medullaris (fig. 2) than in any of the upper regions of the chord, and continues to dilate as it descends through the *filum terminale.* It is closely surrounded by a layer of connective tissue, and is also lined with cylindrical or with fusiform epithelium, from the outer extremities of which a number of fine fibres radiate on all sides through the grey substance, and through the anterior and posterior median fissures.

There is nothing peculiar in structure to mark the exact line of junction of the anterior with the posterior cornua; but such a line may be imagined to extend horizontally across from the side of the central canal to the lateral white column. Near the outer extremity of this line, in some regions of the chord, the lateral portion of the grey substance, between the anterior and posterior cornua, consists of a peculiar vesicular tract, which is paler and more transparent than the rest, and which, on account of its position, I have named the *tractus intermedio-lateralis* (*m*, figs. 4, 5, 6, Plate XX).

Each posterior cornu may be divided into two portions: 1. the *caput*; 2. the *cervix*. The *caput* is the broad expanded extremity of the cornu. (*See* figs. 3, 7, Pl. XX, and 8 and 9, Pl. XXI.) The *cervix* includes the remaining portion, as far forwards as the imaginary horizontal line already mentioned. This distinction is founded on the facts: 1. that the *caput* cornu posterioris differs in structure as well as in form from the cervix; and 2, that in the *medulla oblongata* it is thrown aside from the cervix, and after being traversed in succession by the roots of the vagus and glossopharyngeal nerves, becomes the principal nucleus of the trifacial.*

* See the author's "Researches on the Intimate Structure of the Brain." Philosophical Transactions, Part I., 1858, Figs. 19 and 23.

Structure of the Caput Cornu Posterioris.—The caput cornu consists: 1, of an outer and comparatively transparent portion—the *gelatinous substance*; 2, an inner and more opaque portion.

1. The outer portion, or *gelatinous substance* is composed of *a*, nerve-cells; *b*, nerve-fibres; *c*, blood-vessels and connective tissue.

a. The nerve-cells are exceedingly numerous, but differ considerably in shape and size; they are round, oval, fusiform, pyriform, crescentic, triangular, or otherwise irregular. The diameter of the smallest is scarcely equal to that of blood-discs; they abound in every part of the gelatinous substance. The largest are equal in size to those of the anterior cornu, but are comparatively few, and found only *near the border* of the gelatinous substance; they are elongated transversely, obliquely, and longitudinally, and send their processes in all these directions, and into the posterior and lateral white columns.

b. The nerve-fibres are all tubular, and vary much in size, but the majority are of small diameter; they run longitudinally, transversely, and with various degrees of obliquity, frequently changing their course from one direction to another, and becoming continuous at intervals with the posterior roots of the nerves.

2. The inner and more opaque portion of the *caput* cornu (*h* fig. 2, *et sequent*, Plate XX), besides blood-vessels and connective tissue, consists of: *a*, numerous bundles of longitudinal, transverse, and oblique fibres, continuous with the posterior roots; *b*, nerve-cells.

a. The longitudinal and oblique fibres, which are the chief cause of its opacity, are coarser, and collected into thicker bundles than those of the gelatinous substance, which, however, they immediately adjoin.

b. The nerve-cells are comparatively few, and nearly all of small or intermediate size.

Structure of the Cervix Cornu Posterioris.—Nearly the whole inner half of the cervix cornu is occupied by a remarkable and important column of cells in intimate connexion with the posterior roots of the nerves. (*See* Plate XX, *l*, figs. 3, 4, 5, 6, &c.) These columns, which I have named "*columnæ vesiculares posteriores*,"—posterior vesicular columns—extend through the whole length of the chord, but vary somewhat in size and appearance in different regions. Both in *man* and *mammalia* their diameter is greatest in the upper third of the lumbar enlargement (*see* fig. 4 *l*, Plate XX), where they are more or less oval, somewhat circumscribed, and thickly interspersed with large, oval, fusiform, triangular and stellate cells, and a few others of a smaller kind. The processes of these cells are prolonged in every direction,—transversely, longitudinally, and obliquely:

transversely they are continuous on the one hand with the posterior roots of the nerves, and on the other hand with the posterior commissure. Through the *lower* part of the lumbar and the *middle* of the cervical enlargement in man, the majority of the cells are small, but in mammalia the larger cells are more numerous. Through these columns bundles of the posterior roots interlace with each other in every direction; some of their fibres being continuous with the cells, others passing between them to join the posterior commissure.

The lateral or *outer* half of the cervix consists of scattered cells of various shapes and sizes, which are also traversed from behind forwards by the posterior roots, with some of which they are partly continuous. At its junction with the *caput* cornu it is pierced by a variable number of longitudinal bundles of fibres (fig 7 *o*, Pl. XX) with intervening cells, which sometimes partially embrace them. Sometimes these bundles extend through the whole breadth of the cervix, but are generally confined to its lateral or outer half. They are most numerous and largest in the upper part of the cervical region (fig. 8, Pl. XXI), and in the lower part of the *conus medullaris* (fig. 1, Pl. XX), where they are seen as part of the lateral column, encroaching on the grey substance, which forms a complete network between them.

Structure of the anterior Grey Substance.—In the *filum terminale* the entire grey substance consists only of a *narrow fringe*, which immediately surrounds the dilated canal, except in front, at the bottom of the anterior fissure. This fringe contains a number of very small oval, fusiform, and crescentic cells, which resemble those of connective tissue, and are continuous with fibres which run out through the white substance towards the surface of the chord. As the grey substance ascends, however, it increases in quantity, and projects forwards on each side to form the anterior cornu, at the extremity of which a few large cells are grouped together. Through the *conus medullaris* and lumbar enlargement these large cells continue to increase in number, in proportion to the size of the anterior roots of the nerves, and form several large groups, chiefly in the outer half of the cornu. The large cells of the anterior grey substance differ from each other considerably in shape; they are round, oval, fusiform, triangular, or variously stellate; their delicate processes are from at least two to eight, or perhaps more, in number; they extend in different directions, transversely, obliquely, and longitudinally, and divide into numerous branches; some of them are prolonged into the antero-lateral white columns, others into the anterior roots of the nerves. At the lower part of the *conus medullaris*, and at the upper part of the cervical region particu-

larly, the anterior portion of the grey cornu is pierced by considerable bundles of longitudinal fibres, between which some of the cells are located, and the fibres of the anterior roots—especially in the cervical region—form an intricate plexus.

Of the Tractus Intermedio-lateralis.—This tract, which I have so named on account of its position, lies between the anterior and posterior cornua, at the lateral part of the grey substance (*m*, figs. 4, 5, and 6, Pl. XX). It consists of cells, which are mostly round, oval, fusiform, and triangular, but of smaller and more uniform size than those of the anterior cornu. It extends from the upper part of the lumbar to the lower part of the cervical enlargement, but is largest along the upper fourth of the dorsal region. It is reached by both the anterior and posterior roots of the nerves, and the processes of some of its cells are continuous with fibres of the posterior transverse commissure. Above the cervical enlargement a similar tract reappears, which is traversed and intimately connected with the lower roots of the spinal-accessory nerve.

Of the Posterior Roots of the Spinal Nerves.—The bundles of fibres which form the posterior roots are much larger than those of the anterior; but their component fibrils are mostly finer and more delicate; they are attached immediately to the posterior white columns only. Fig 1, Pl. XXI, exactly represents a longitudinal section, through the cervical enlargement of the spinal chord of the cat, from the eighth to the twelfth pair of nerves. In this section the bundles which form the posterior roots (*P, P, P, P*) are observed to consist of three kinds, which differ from each other partly in direction, and partly in the size of their component fibrils. The first kind (*a, a, a, a*) enter the chord transversely, and pursue a very remarkable course I have not seen them distinctly below the cervical enlargement. Each bundle, after traversing the longitudinal fibres of the posterior column, P, C, in a compact form and at a right angle, continues in the same direction to a considerable but variable depth within the grey substance (G), dilating, and again contracting in a fusiform manner; it then bends round nearly at a right angle, and running for a considerable distance in a longitudinal direction *down* the chord, sends forward at short intervals a number of fibres into the *anterior* grey substance. In this longitudinal course it is joined by other bundles above and below it, which contribute to form a continuous band. Of the fibres proceeding from this band, some appear to form loops within the grey substance, particularly near its border; others extend directly into the lateral and the anterior white columns, A, C, and then

bending round, both *upwards* and *downwards*, are seen sometimes to re-enter the grey substance, and sometimes to resume a *longitudinal* course *within the white* columns in which they become lost.

The second kind of bundles (*b, b, b*) traverse the posterior columns more or less transversely, or in different planes, interlacing each other in an intricate manner, and extending from without inwards, nearly as far as the posterior median fissure. (*See* also fig. 2, Pl. XXI.) Crossing the gelatinous substance, some of them become immediately continuous *chiefly* with the posterior, but *partly* with the anterior commissure; others interlace in every direction through the *posterior vesicular columns*, with the cells of which they are continuous; some return to the lateral and posterior white columns, after traversing different parts of the grey substance; whilst the rest descend to the anterior cornu, and form a plexus amongst its cells. In the *cervix cornu posterioris* therefore, these bundles cross each other in a great variety of ways, both in the same and in different planes. (*See* fig. 2, Pl. XXI). The third kind of bundles also enter the chord more or less transversely: a few of these fibres proceed near the surface, both *upwards* and *downwards*, and pass out again with the roots above and below them.* The rest cross the posterior white columns, obliquely and chiefly *upwards*, a small number only running downwards. Interlacing at the same time with each other and the roots already described, they diverge, and for the most part reach the grey substance at points successively more distant from their entrance in proportion to the obliquity of their course; the remainder or most divergent taking a longitudinal course with the fibres of the posterior white columns, amongst which they become lost. It is impossible to say whether these latter fibres are continued as far as the brain, or whether they ultimately reach the grey substance of the chord.

Of the Anterior Roots of the Spinal Nerves.—These are attached exclusively to the anterior parts of the antero-lateral columns, which they traverse in separate bundles. (Fig. 1 and 2, Plate XXI). Unlike the posterior roots, they do not cross or interlace with each other until they reach the grey substance; here they divide into smaller bundles, or into separate fibrils which cross each other and diverge in every direction, like the expanded hairs of a brush; some of them run out into the lateral columns on one hand, and on the other

* In the *abdominal chord* of the *articulata* these looped returning fibres are very numerous. *See* "The nervous system of Lumbricus terrestris," by the Author.—*Proceedings of the Royal Society*, Jan 27, 1857.

into the anterior columns, where they decussate with corresponding fibres of the opposite side in front of the spinal canal, and in company with fibres from the posterior roots. (Fig. 1, Pl. XXI.) Some bend round, and take a more or less longitudinal course, both *upwards* and *downwards*; a few may be seen to terminate in the vesicles, while others, after winding between them, curve inwards to join the posterior transverse commissure.

It may be considered, then, as a fact that the *majority* of the fibres composing the roots of the spinal nerves proceed *directly* to the grey substance of the chord; and that if any of them, without entering it, ascend at once to the brain, it can be *those* only of the *posterior* roots which run longitudinally in the posterior columns. But even if they reach the brain, the number of these latter fibres is too small for the transmission of sensory impressions from all parts of the body.

Upon these anatomical grounds I concluded that the posterior white columns are not the only channels of communication between the sensorium and the posterior roots.* The correctness of this conclusion has since been confirmed by the experiments of Dr. Brown-Sèquard, who endeavours to prove that sensory impressions are conveyed chiefly by the posterior *grey* substance, and thinks that they are transmitted partly by the bundles of longitudinal fibres which I first described in the opaque portion of the *caput cornu*, and partly by the cells on each side of the central canal. I have already shown that in this latter situation a considerable part of the grey substance forms the *posterior vesicular column* which is so intimately connected with the posterior roots of the nerves; but whether the roots in connexion with the cells of these columns are composed of *sensory* fibres, or whether they are afferent fibres of *another* kind, is uncertain. I have also shown that some of the fibres of the posterior roots, after running longitudinally downwards through the centre of the grey substance, escape into the *anterior* white columns along which they pursue both an *ascending* and descending course; and Dr. Brown-Sèquard has found that the deep fibres of the *anterior* columns, near the

* "Philosophical Transactions," 1853, part I, p. 351. In referring to this conclusion Dr. Brown-Sèquard has entirely overlooked the above anatomical facts upon which it was mainly grounded, and mentions only another *corroborative* statement, which I added, viz., that the connexion of the posterior roots exclusively with the cerebellum tends to the same conclusion. His words are, in speaking of me, "as had been already done by Sir C. Bell and Dr. Todd, he tried to show that the posterior columns, *being united with the cerebellum*, could not be considered as the only conductors of the sensitive impressions."—*Lancet*, lect. 2nd. This statement was scarcely worth mentioning without the description which I have above given of the destination of the posterior roots; so that the facts of the case are only partially represented.

verge of the grey substance, are partly employed in transmitting sensory impressions.

Stilling inferred from his own experiments that the anterior grey substance is the only conductor of voluntary power from the brain to the anterior roots of the nerves; and the office of conduction he assigned to a *system* of fine *grey* longitudinal fibres, which he thought he had discovered in this part. I have ascertained, however, that no such system of fibres has any actual existence; but in the lower part of the *conus medullaris* offsets of the *anterior* grey substance extend, as a kind of coarse network containing large nerve-cells, into the anterior white columns, to near the surface of the chord; and in the upper part of the cervical region, as already stated, the anterior grey substance is encroached upon and pierced by numerous *bundles* of the *white columns* between which the cells are located and the fibres of the anterior roots form a plexus or network. These longitudinal bundles are probably subservient to the transmission of voluntary power. But according to Dr. Brown-Sèquard, while in the *dorsal* and *lumbar* regions the anterior columns and grey substance alone seem to have the function of conductors for voluntary movements, the same function, near the commencement of the *medulla oblongata*, appears to be performed chiefly, if not entirely, by the *lateral white* columns and part of the *anterior grey* substance. We have seen that, in this region particularly, the lateral part of the grey substance (fig. 8 *o*, Pl. XXI) forms a remarkable network around numerous bundles of the lateral white columns; but a somewhat similar network is observable in the lower part of the *conus medullaris*, and in all regions of the chord the *cervix cornu posterioris* is pierced by a variable number of *longitudinul* bundles which may be traced uninterruptedly to the lateral column. (*See* Pl. XX.) From my own observations, it would appear that many of the fibres and nerve-roots which leave the grey substance re-enter it at various intervals, after running for a certain distance both *upwards* and *downwards* along the white columns. Such a course may be taken for the purpose of stimulating particular parts, without affecting those which are intermediate.

The fact that many fibres of each root, on entering the grey substance, extend both *upwards* and *downwards* to a considerable distance beyond their point of entrance, may serve to explain how impressions made at one particular spot are communicated in different directions to distant parts of the chord, so as to excite a simultaneous and co-ordinate action in classes of muscles which would otherwise be unconnected.

ON THE INFLUENCE OF MERCURIAL PREPARATIONS UPON THE SECRETION OF BILE.

By George Scott, M.D.,

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THE following experiments were made with the view of ascertaining whether the preparations of mercury really increase the flow of bile, as has hitherto been generally believed. The ductus communis choledochus having been tied in a dog so as to prevent any bile reaching the intestine, the gall-bladder was opened to allow all the bile secreted to escape externally. It was then collected in a way which will be described below, and, calomel being given at different periods, the effect of the same on the quantity of bile secreted was carefully noticed.

After describing the operation and the mode of collecting the bile, and before detailing the experiments with calomel, I shall say a few words regarding the normal amount secreted by the liver in twenty-four hours, as very various opinions have been offered on this point by different observers, and as the method I have employed seems sufficient to enable one to arrive at a tolerably correct conclusion.

On the 25th May, 1858, a middle-sized, black, rough, mongrel dog was operated upon for biliary fistula in the following manner:—

When fully under the influence of ether, an incision from three to four inches long was made in the linea alba through the abdominal walls, beginning just below the ensiform cartilage. The peritoneum and great omentum being incised to about the same extent as the integument and muscles, and the lower edge of the liver being a little raised, the gall-bladder was easily seen. A ligature being passed through its upper end, it was gently drawn towards the surface, and the duodenum being somewhat depressed, the ductus communis choledochus was seen without difficulty entering the intestine. The common bile-duct was tied in two places as near the duodenum as possible, and divided between the two ligatures. An opening was made in the upper end of the gall-bladder large enough to admit the forefinger; this was sewed to the edges of the upper end of the wound, and the latter was closed by ligatures up to the point where the gall-bladder was fastened. The wound was further

closed by several broad bands of adhesive plaster, and a broad linen bandage was placed over the whole.

The dog did very well, and recovered rapidly from the effects of the operation, so that on the 4th June his appetite was good, the wound was nearly healed at the lower part, and the fistula was quite patent.

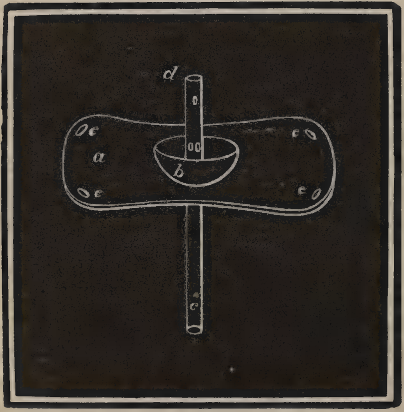
7th June.—Is very lively and in good health. His weight was to-day ascertained to be 18lbs. 6oz. He has been fed on rice, milk, and boiled horse-flesh, but chiefly on the latter.

On the 9th June the dog was in such good health, and the wound was so well healed, that the collection of bile was commenced in the following way:—

Fig. 24.

The first part of the apparatus was a silver tube, represented in Fig. 24, about two inches long and a quarter of an inch in diameter, fitted in the middle and at right angles to it with a disk *a* (Figs. 24 and 25) about three inches long, and wider at both ends than in the middle. On one side of the disk was attached a circular cup-shaped piece of silver, *b b* Figs. 24 and 25, with a thick border, allowing the tube to pass through its centre, Fig. 25, *b d*. The part of the tube *d* was perforated with holes, several of which were at the base of *d*, and in such a position that if fluid were poured into the metallic cup *b*, when the tube was in a vertical position, as in Fig. 24, it would flow into the part of the tube *c*.

Fig. 25.



It will be observed that the tube on meeting the disk *a* is bent somewhat on itself. This is to allow the part of the tube *c* to hang vertically, notwithstanding the oblique position of the disk *a*, owing to the inclined shape of the body of the dog at the fistula, which was just at the point of meeting of the chest and abdomen.

The part *d* was inserted into the fistula, and the tube was fixed in its place by elastic bands attached to the holes *e e e e*, and fastened round the body. It was attached sufficiently tightly that the cup *b* was always applied firmly against the abdomen, so that no fluid could escape between it and the part around the fistula against which it was applied. Thus, if any of the bile escaped out of the fistula by the side of the tube *d*, it would only pass into the cup *b*, and then by means of the holes at the base of *d* it would pass into the tube *c*. Thus was prevented any loss of bile from its not all passing into the tube *d*.

Fig. 26.

The next part of the apparatus was a glass of the shape represented in Fig. 26. Up to the dotted line *d* it would contain about 1,500 grains of bile. The opening at *a* was provided with a cork perforated at the centre, so as to admit the end of the tube *c* easily, and having also several small holes perforated around the large one to admit air. The opening at *b* was also provided with a tightly fitting cork. In the first experiments the glass that was used had merely a circular hole at *b*, and was not provided with a rim, as here represented. It was found very difficult to close this opening completely, and hence some of the loss in the first experiments. From the 1st July, however, glasses similar to the one represented in Fig. 26 were used. The glass was also provided with a funnel-shaped tube *c*. By this latter arrangement it will be easily understood that when the glass was filled with bile or any other fluid up to the dotted line *d*, the same could not escape in any position which the dog might assume so long as the cork remained tightly fitted in the opening *b*.

The part of the silver tube *c* was placed through the hole in the cork at *a*, and the glass was kept attached to the tube by being tied firmly round the body with a simple piece of tape. Then over all was fitted a large piece of gutta percha, about a quarter of an inch thick, and reaching over the lower end of the thorax, most of the abdomen, and over both sides of the animal. It was moulded to the shape of the body and of the glass, so

that the latter lay in a large cup-shaped cavity of gutta percha. This shield was buckled over the back of the dog sufficiently tight to prevent any shifting of the apparatus during the movements of the animal. The cup of gutta percha receiving the glass was sufficiently large that when the dog was lying on it the shield did not press upon the tube or glass, but the latter lay in its covering quite secure from injury or pressure.

In collecting the bile the glasses were changed twice in the twenty-four hours, in the morning and evening, and the tube was removed from the fistula each time that the glasses were changed, in order to clean it and to wash out the wound.

The glass and corks having been carefully cleaned and weighed before they were applied, the weight of the fluid bile removed from the dog was easily ascertained by subtracting the weight of the glass and corks from the whole weight of the apparatus taken from the animal. The bile thus obtained in the evening being carefully covered up so as to prevent any evaporation from its surface, on the following morning, the glass was removed in the same way as before and weighed. The weight of the bile of the preceding evening being added to the amount obtained in the morning, the whole was reckoned as the bile of the same day as the morning. Thus the bile obtained on the evening of the 9th June, and that obtained on the morning of the 10th June, were reckoned as the bile of the 10th June. The bile obtained on the evening of the 10th June, and that obtained on the morning of the 11th June, were reckoned as the bile of the 11th June, and so on. If both glasses had been applied during exactly twenty-four hours, then the bile for that period was at once known; if they had been applied during only twenty-two or twenty-three hours, or any other period longer or shorter, then the amount of bile for twenty-four hours was calculated from the quantity actually obtained. In the majority of cases, the glasses having been changed at the same time every morning, the amount of bile for twenty-four hours was really collected. It was only in some cases that, owing to the glasses having been removed at a later or earlier hour in the morning, the quantity of bile was collected for either a greater or lesser period than twenty-four hours. In almost all the latter cases the time during which the bile was obtained was within an hour or two more or less of twenty-four hours. Thus, to give an illustration, the bile collected on the 10th June was for a period of twenty-two hours and a quarter, 837·2 grains, therefore the calculated amount for twenty-four hours was 903·04 grains. On the 11th June, the bile collected was for a period of twenty-four hours, 1628 grains. On the 12th, the

amount collected was, also for twenty-four hours, 1767·7 grains. On the 13th, the quantity collected was, for twenty-four hours and three quarters, 2365·2 grains; therefore for twenty-four hours 2293·527 grains, and so on.

After the morning bile was weighed it was mixed with that of the preceding evening, and then a certain portion, never less than 500 grains, generally from 800 to 1,000 grains, was weighed out and analyzed, and the analysis of the whole amount of bile in the twenty-four hours calculated from this.

In the above manner I have succeeded in collecting very nearly *all* the bile secreted in twenty-four hours. Some cotton wool was always placed between the glass and gutta percha shield holding the same, so that if any bile escaped it could be easily detected from the green stain on the white wool. In the first experiments, those viz. from the 9th to the 19th June, there was always a little bile lost, owing to the cork not closing very tightly the hole in the glass at *b*. After, however, the glasses were provided with a rim at *b*, as represented in Fig. 26, this opening was so completely closed that no bile whatever escaped; and from the 1st July no bile was lost in the collecting, with the exception of a few drops on the 8th and 9th July. Of course a drop or two of bile escaped from the fistula during the changing of the glasses, but as the time employed for that process never exceeded a quarter of an hour, the amount thus lost was very inconsiderable. In the first experiments only twice, viz., on the 12th and 19th June, did the quantity lost exceed a few drops. On the other hand, it will be easily understood that although a few drops of the amount of bile obtained in twenty-four hours was lost, that by no means invalidates the results obtained with the calomel, as, of course, the loss day by day was very nearly the same, and the amount of bile collected was so great that the difference of a few drops would, in a very small degree, influence the results.

In the observations below regarding the daily amount of bile secreted by the liver, it must be understood that, owing to the slight loss above noticed, the quantity here given is rather *under* than *over* the proper quantity, as the amount has always been calculated from the quantity actually obtained.

The amount of bile secreted by the liver in twenty-four hours has been very variously stated by different observers. It seems proper to assume that the liver of any animal secretes a quantity of bile proportionate to the weight of the organ. Hence in animals with a relatively large liver, the daily amount of bile secreted for the weight of the body will be greater than the quantity of bile daily secreted by animals with a relatively

smaller liver. The weight of the liver of the dog is, from six observations of Bidder and Schmidt, as 1 to 26 of the whole body. The weight of the liver in man is, according to Quain, as 1 to 36 of the whole body. Hence we may conclude that a dog secretes daily more bile according to the weight of its body than a man. The greater relative weight of the liver in the dog than in man has always, therefore, been taken into consideration in estimating from the amount of bile secreted by the dog, the amount which a man of a certain weight should secrete in twenty-four hours.

	Fluid Bile.		Bile Solids.	
	Oz.	Grains.	Oz.	Grains.
Haller calculated that a man secreted in 24 hours	24	or 10500		
Douglas	29	or 12687		
Bouisson	6·777	or 2965		
Blondlot	7·058–8·825	or 3088–3861		
Platner calculated that a dog weighing from 19 to 21 lbs. secreted in 24 hours 5 to 6 oz. of bile, or, calculating that a human being would secrete the same proportionate amount of bile according to the relative weight of his liver, a man weighing 160lbs. would secrete in 24 hours about	31·777	or 13902		
Bidder and *Schmidt* calculate that for every 1 kilogr. or 2·20628lbs. of dog, there are secreted in 24 hours 19·99 grammes of fluid bile, and 0·988 grammes of solids. Considering the relative weight of his liver, a man weighing 160lbs. would, according to this, secrete in 24 hours ..	35·476	or 15521	1·824	or 798
Kölliker and *Müller* calculate that for every 1 kilogr. or 2·20628lbs. of dog, there are secreted in 24 hours 36·1 grammes of fluid bile, and 1·162 grammes of solids. A man weighing 160lbs. would, according to this, secrete in 24 hours	66·742	or 29200	2·146	or 939

It is an acknowledged fact that the quantity of bile secreted by the liver in a given time is very materially affected by the amount of food and drink taken. Hence it is indispensable in forming a correct conclusion of the amount of bile daily secreted to take into account the quantity of food and drink consumed. Of the above-mentioned observers only Bidder and Schmidt and Kölliker and Müller have given the quantity of food consumed by the animals experimented on; and it is, therefore, only with the results of the above four that the present experiments can be compared.

Of course, in estimating the amount of bile secreted in twenty-four hours by collecting the same from a biliary fistula, it is necessary to ascertain for certain that all the bile secreted by the liver escapes externally at the fistula. Now there are two ways in which the latter may be prevented.

1. Some of the bile may be re-absorbed into the blood by stoppage of any of the hepatic ducts, or by partial obstruction of the fistula. Under such circumstances, of course, the animal will become icteric, and bile-constituents will be detected in the urine. That no such thing took place in my dog is sufficiently proved by the fact that he had never any symptoms whatever of jaundice, and that, although the urine was many times collected and tested for bile-colouring matter and for bile acids, the results were always negative.

2. Recommunication may take place between the ductus communis choledochus and the duodenum, as has sometimes happened in cases of biliary fistula. That such did not, however, occur in the present case, will be seen by the following account of the post-mortem examination of the dog. I have thought it best to give the latter in this place in connection with the above remarks.

On the 14th August, eleven weeks and four days after the operation, the dog was in very good health, although very much emaciated. It was killed the same evening by blows on the head.

Post-mortem examination about forty-four hours after death.

Body much emaciated. Fistula quite patent, of about the diameter of a goose-quill, the edges besmeared with bile.

On opening the abdomen, the liver on its upper surface was seen to be adherent to the under surface of the diaphragm to a considerable extent—the adhesions were very firm. The duodenum and pancreas were firmly adherent over a considerable extent, to the under surface of the liver. On cutting open the fistula into the gall-bladder, some brown thick bile escaped. On tracing the cystic into the hepatic ducts, the ductus communis choledochus was seen to end in a cul-de-sac a short distance from the opening of the last hepatic duct into it. On opening the duodenum, and passing a probe through the orifice of the common bile-duct into the gut, and pushing the probe as far as it would go, this part of the duct was seen also to end in a cul-de-sac about $\frac{5}{8}$ths of an inch from the outside of the duodenum. The two portions of the common bile duct were separated by an interspace of about half an inch, and were both of them quite closed. No bile, therefore, could possibly have reached the duodenum from the time the operation was per-

formed. The liver presented at one or two parts some whitish-gray specks on the surface, of about the size of a pin's head. These were seen to enter the substance of the organ for a short distance. The liver was otherwise perfectly healthy in appearance.

The *stomach* and the upper part of the *small intestines* were full of the remains of food. The mucous membrane of the stomach and intestines was perfectly normal in appearance, except that of the vermiform process and rectum. The mucous membrane here presented a number of roundish patches of pigment, or rings of pigment, about the size of a pea, some scarcely so large, and placed very close to each other, giving the membrane a curious variegated appearance. There was no unevenness of the membrane at these pigmented rings, as if they had been caused by ulceration or cicatrization. There was some calcification of the cortical substance of the *kidneys*, otherwise these organs were perfectly healthy in appearance. *Supra-renal bodies, spleen,* and *pancreas* healthy.

In the *thorax*, the right auricle of the *heart* was quite filled with a clot of decolorized fibrine, which extended a long way into the vena cava inferior. The right ventricle contained a good deal of dark-coloured loose coagula, with a little decolorized clot. In the left auricle was also a little decolorized clot. Left ventricle empty. The tricuspid and mitral valves looked a little thickened and gelatinous at the base, but not much. Otherwise *heart* and its valves perfectly healthy.

Right *lung* anæmic, otherwise perfectly normal. Left *lung* somewhat hyperæmic and œdematous.

Table I. gives a full account of the quantity of bile collected each day, all the analyses of the same, the amount of food and drink daily consumed, the doses of calomel given, &c., &c., &c.

The amount of bile being estimated from morning to morning, and the food and drink always being given *after* the morning's bile was collected, it follows that the quantity of food of one day must have affected the quantity of bile of the *next* day. Hence, in Table I, I have placed opposite the bile of 10th June the food and drink actually given on the 9th, opposite the bile of the 11th June the food and drink actually given on the 10th, and so on.

In estimating the amount of bile secreted in twenty-four hours by this dog, I have taken the average of the first three days of July, as these appear to be the most correct of all the experiments. The dog was then in excellent health, a period of five weeks had elapsed since the operation, his appetite was very good, and the apparatus for collecting answered so well that the bile was obtained *without any loss,* except that unavoidable

TABLE I.

Date.	Amount of fluid Bile collected in 24 hours.	Amount of Bile Solids collected in 24 hours.	Amount of Taurocholic or Choleic Acid collected in 24 hours.	Amount of Glycocholic, or cholic Acid collected in 24 hours.	Fat.	Salts.	Mucus and slight amount of colouring matter.	Loss.	Notice of amount of Bile lost in collecting.	Food,	Drink.	Doses of Calomel given.	Weight of Dog.	Observations.
	Grains.		Grains.		Grains.									
9 June	—	—	—		—	—	—	—	—	3500 grns. of boiled horse-flesh	18 oz. milk 10 oz. water	—	18 lbs. 6 oz. on 7th June.	
10 „	903·040	89·57	—		—	—	—	—	Some drops lost	1118·4 grns. of boiled horse-flesh	21 oz. milk 16 oz. water			
11 „	1628·000	103·93	—		—	—	—	—	Some drops lost	5760 grns. of boiled ox-liver	18 oz. milk 11 oz. water			
12 „	1767·700	80·012	11·637		38·073	12·321	16·709	1·272	Considerable amount lost	2943 grns. of boiled ox-liver	12 oz. milk 8 oz. water			
13 „	2293·527	104·947	32·864		28·698	23·026	19·379	·980	Some drops lost	2362 grns. of boiled ox-liver	19 oz. milk 1½ oz. water	At 3 P.M., about 3 grns. in bread-crumbs		As far as was seen, calomel did not purge him.
14 „	1819·636	99·636	26·230		42·636	15·293	15·474	·003	Scarcely any lost	910 grns. of boiled ox-liver	11 oz. milk 9½ oz. water			
15 „	896·680	41·361	—		—	—	—	—	Scarcely any lost	2440 grns. of boiled ox-liver	18 oz. milk 6 oz. water			
16 „	1639·968	77·599	12·502		35·199	13·204	13·923	2·771	Scarcely any lost	3146·3 grns. of boiled ox-liver	18½ oz. milk 8 oz. water	At ½ past 11 A.M., 6 grns. in bread-crumb		Calomel purged him twice within 4 hours.
17 „	518·700	42·180	10·426		13·199	6·478	10·102	1·975	Some drops lost	No food	12 oz. milk 13 oz. water			
18 „	1810·540	64·930	22·191		8·717	21·216	12·804	·002	Some drops lost	3900 grns. of boiled ox-liver	17 oz. milk 6½ oz. water			
19 „	817·717	61·776	27·486		13·166	11·106	10·016	·002	A considerable amount lost	No food	No milk 9 oz. water	—	16 lbs.	
30 „	—	—	—		—	—	—	—	—	7000 grns. of boiled ox-lung	14 oz. milk A little water	—	17¼ lbs. on 29th June.	
1 July	2168·051	124·728	40·909	8·251	30·665	24·825	12·615	7·463	None lost	7000 grns. (1 lb.) of boiled ox-lung	20½ oz. milk			
2 „	2941·239	132·171	57·572	2·764	18·611	33·924	19·298	·002	None lost	7000 grns. of boiled ox-lung	18½ oz. milk		—	
3 „	3148·400	146·332	47·870	15·725	16·828	36·097	29·809	·003	None lost	7000 grns. of boiled ox-lung	18 oz. milk ½ oz. water	At ½ past 4 P.M., 10 grns. in bread-crumb		It is uncertain whether the calomel purged him.
4 „	2560·300	135·613	45·543	22·459	13·933	29·767	23·908	·003	None lost	7000 grns. of boiled ox-lung	13 oz. milk ½ oz. water			
5 „	2881·500	135·260	47·445	25·878	12·568	33·608	15·758	·003	None lost	6000 grns. of boiled ox-lung	About 10 oz m. ½ oz. water			
6 „	2644·300	124·784	54·169	8·680	14·569	31·087	12·822	3·457	None lost	7000 grns. of boiled ox-lung	20 oz. milk			
7 „	2672·900	110·771	48·748	3·325	13·532	27·882	10·698	6·586	None lost	7000 grns. of boiled ox-lung	15½ oz. milk	At ¼ to 6 P.M., 12 grns. in bread-crumb	—	Calomel purged him copiously.
8 „	1963·500	94·304	40·288	8·900	14·427	21·306	9·329	·054	Some drops lost	7000 grns. of boiled ox-lung	14½ oz. milk			
9 „	1486·400	77·062	39·008	3·775	9·710	15·052	7·907	1·610	Some drops lost	7000 grns. of boiled ox-lung	8 oz. milk			
10 „	—	—	—	—	—	—	—	—	—	—	—	—	16 lbs.	

one of two or three drops during the period of changing the glasses.

On referring to Table I. it will be seen that the average amount of bile secreted for these three days, viz., 1st, 2nd, and 3rd July, was 2752·562 grains of fluid bile, and 134·410 grains of solids. The dog weighed on the 29th June 17¼lbs., therefore his average weight for the above three days may be taken as 17lbs. The average amount of food was 7000 grains, or 1lb. of boiled ox-lung. The average amount of drink was 19oz. or 8312·5 grains of milk.

	Fluid Bile.	Bile Solids.
	Grains.	Grains.
Or 1 kilogr. or 2 20628lbs. of dog, on a diet of 908·468 grains of meat, and 1078·787 grains of milk,* or 1068 grains meat, give in 24 hours..	357·23	17·443
Bidder and *Schmidt* calculate that each 1 kilogr. or 2·20628lbs. of dog on 882·2 grains of meat, 6·7 grains of lard, and 30·3 grains of milk, give in 24 hours	296·371	15·258
Kölliker and *Müller* calculate that each 1 kilogr. or 2·20628lbs. of dog on 988·421 grains of meat, give in 24 hours	557·528	17·945

	Fluid Bile.	Bile Solids.
Or, according to the *present experiments*, a dog consuming daily about $\frac{1}{14}$th of its own weight of meat, secretes in 24 hours	23·13 in 1000 of its own weight.	1·129 in 1000 of its own weight.
According to *Bidder* and *Schmidt*, a dog consuming daily about $\frac{1}{17}$th of its own weight of meat secretes in 24 hours	19·19 in 1000 of its own weight.	·987 in 1000 of its own weight.
According to *Kölliker* and *Müller*, a dog consuming daily about $\frac{1}{15}$th of its own weight of meat, secretes in 24 hours	36·1 in 1000 of its own weight.	·1·161 in 1000 of its own weight.

Bidder and Schmidt calculate that dogs and cats in a healthy condition require for each kilogr. of weight of body, 50 grains, or $\frac{1}{20}$th of their own weight of fresh meat daily. Considering, therefore, that animals with biliary fistulæ require more nutriment than healthy ones,† the above amount of food given daily to the animals experimented on, seems to have been not more than their condition required. Hence it appears reasonable to suppose that a man *on full diet* would secrete, for the weight of his body, an amount of bile proportionate to that secreted by

* 1078 grains of milk give about 160 grains of solids. Calculating roughly that the latter amount of milk solids contain about the same quantity of nourishment as meat, then the amount of food in this case for each 1 kilogr. of dog would be 908 grains + 160 grains = 1068 grains of meat.

† See Die Verdauungssäfte und der Stoffwechsel, von Dr. F. Bidder und Dr. Schmidt. Art.: von der Galle.

the dogs above referred to, always taking into consideration the greater relative weight of the liver in the dog than in man.

	Fluid Bile.		Bile Solids.	
	Oz.	Grains.	Oz.	Grains.
Therefore, according to these experiments a man weighing 160lbs. would secrete in 24 hours	42·763 or	18709	2·084 or	912

The results arrived at above will be best understood by referring to Table II.

Table II.

Observers.	Daily amount of Meat in proportion to the weight of Dog.	Amount in Grains of Fluid Bile secreted in 24 hours for each kilogramme, or 2·20628lbs. of Dog.	Amount in Grains of Bile Solids secreted in 24 hours for each kilogramme, or 2·20628lbs. of Dog.
Bidder and Schmidt.	$\frac{1}{17}$th	296·371	15·258
Kölliker and Müller.	$\frac{1}{15}$th	557·528	17·945
We.	$\frac{1}{14}$th	357·23	17·443

Observers.	Amount in Oz. and Grains of Fluid Bile secreted in 24 hours by a Man, on full diet, weighing 160lbs.		Amount in Oz. and Grains of Bile Solids secreted in 24 hours by a Man, on full diet, weighing 160lbs.	
	Oz.	Grains.	Oz.	Grains.
Bidder and Schmidt.	35·476 or	15521	1·824 or	798
Kölliker and Müller.	66·742 or	29200	2·146 or	939
We.	42·763 or	18709	2·084 or	912

Kölliker tried the effects of calomel upon the secretion of bile in dogs, with biliary fistulæ, but it is difficult to form any definite conclusion from his observations in this respect. *Once* the bile seemed to be *increased*, and *twice* it seemed to be *diminished* by the administration of calomel. (Vide the Würzburg Verhandlungen, vol. v., 1855, page 231.)

In judging of the effects of calomel on the secretion of bile, I have, in all the experiments but one, calculated the average amount of fluid bile and bile solids secreted in twenty-four hours

two days *previous* to the exhibition of the medicine, and then the average amount secreted in twenty-four hours two days *after* the calomel was given. This seemed to be the most correct method of arriving at a proper conclusion, as it might be supposed that the effects of a large dose of calomel lasts longer than twenty-four hours.

The calomel was given each time after the morning's bile was collected, therefore the effect of the medicine was upon the bile of the day *following* the one on which it was given. Thus the calomel administered on the 13th June affected the bile of the 14th June, that given on the 16th June affected the bile of the 17th, and so on.

In the following observations the weight of the dog is not mentioned, as the variation in the same during the period of each experiment must have been but slight, and could not have affected the results obtained.

The first dose of three grains of calomel was given at three p.m. of the 13th June.

	Grains of Fluid Bile.	Grains of Bile Solids.	Grains of Bile Acids.
The average amount of bile secreted in 24 hours for two days *previous* to the administration of calomel, viz., 11th and 13th June,* was	1960 763	104·438	32·864
The average amount of food was, for the two days, 11th and 13th June, 4061 grains of boiled ox-liver, and the average amount of drink was 18½ oz. milk, and 6¼ oz. water.			
After giving the 3 grains of calomel, the average amount of bile secreted in 24 hours for two days, viz., 14th and 15th June, was	1358·158	70·498	26·230
The average amount of food and drink for the two days, viz., 14th and 15th June, was 1675 grains of boiled ox-liver, 14½ oz. of milk, and 7¾ oz. of water.			
Here we find that after the exhibition of calomel, the quantity not only of fluid bile, but also of the bile solids and bile acids, was considerably diminished. The diminution may no doubt be partly due to the much smaller amount of food taken *after* than before the calomel was given.			
The second dose of 6 grains of calomel was given at half-past eleven a.m. of the 16th June. The amount of bile secreted in 24 hours of 16th June, the day *previous* to giving the above dose of calomel was ..	1639·968	77.599	12·502

* The numbers obtained on the 12th June are not used, owing to there having been a considerable loss in collecting the bile on that day.

The quantity of food and drink consumed on the 16th June was 3146 grains of boiled ox-liver, 18½ oz. milk, and 8 oz. water.

	Grains of Fluid Bile.	Grains of Bile Solids.	Grains of Bile Acids.
After giving the 6 grains of calomel, the quantity of bile secreted in the 24 hours of the 17th June was	518·700	42·180	10·426
No food was taken on the 17th June,* and the amount of drink was 12 oz. milk and 13 oz. water.			
Here again we find the fluid bile, the bile solids, and bile acids, remarkably diminished after the exhibition of calomel. The dog in this case took no food on the 17th June, the day *after* the calomel was given to him. Hence it might be concluded that the remarkable diminution in the quantity of bile secreted in this case as in the previous one, was due entirely to the great diminution in the amount of nutriment taken. To ascertain whether such a diminution in the quantity of food consumed was sufficient of itself to cause such a decrease in the amount of bile secreted, nothing but 9 oz. of water was given to the dog on the 18th June,† and the amount of bile secreted in 24 hours on the 19th June was	817·717	61·776	27·486

Of this latter quantity a considerable amount was lost in the collecting. Therefore we find that in this case, at all events, the mere deprivation of nutriment was not sufficient to cause such a diminution in the flow of bile, as the same cause combined with a dose of 6 grains of calomel.

The third dose of 10 grains of calomel was given at half-past four P.M., of 3rd July.

	Grains of Fluid Bile.	Grains of Bile Solids.	Grains of Bile Acids.
The average quantity of bile secreted in 24 hours for 2 days, viz., 2nd and 3rd July, *before* giving the 10 grains of calomel, was	3044.819	139·251	61·965
The average amount of food and drink for the 2 days, 2nd and 3rd July, was 7,000 grains of boiled ox-lung, and 18¼ oz. of milk.			

* *i. e.* on the 16th June, but it has been placed in Table I. opposite the bile of 17th, as it affects the bile of the latter day.

† Placed, therefore, in Table I. opposite the 19th.

	Grains of Fluid Bile.	Grains of Bile Solids.	Grains of Bile Acids.
After giving the 10 grains of calomel, the average amount of bile secreted in 24 hours for 2 days, viz., 4th and 5th July, was ..	2720·900	135·436	70·662
The average amount of food and drink for the 2 days, 4th and 5th July, was 6,500 grains of boiled ox-lung, and 11½ oz. milk.			
Here with a very slight decrease in the amount of nutriment taken, there is also a diminution of the fluid bile and bile-solids after the calomel, but the decrease is inconsiderable when compared with the two previous results. It will be observed that there is an *increase in the quantity of bile-acids* after the giving of the calomel.			

The fourth dose of 12 grains of calomel was given at a quarter to six P.M., of 7th July.

	Grains of Fluid Bile.	Grains of Bile Solids.	Grains of Bile Acids.
The average amount of bile secreted in 24 hours for 2 days, viz., 6th and 7th July, *before* giving the 12 grains of calomel, was	2658·600	117.777	57·461
The average amount of food and drink for the above 2 days, 6th and 7th July, was 7,000 grains of boiled ox-lung, and 17¾ oz. of milk			
After giving the 12 grains of calomel, the average quantity of bile secreted in 24 hours for 2 days, 8th and 9th July, was ..	1724·950	85·683	45·985

The average amount of food and drink for the above two days, 8th and 9th July, was 7000 grains of boiled ox-lung, and 11¼ oz. milk.

Here with as nearly as possible the same amount of nutriment during the whole period of the experiment, not only the quantity of fluid bile was decreased after the administration of 12 grains of calomel, but also the bile-solids and bile-acids.

In Table III, the results obtained are placed in a connected form.

TABLE III.

No. of experiment.	Period of time over which the experiment lasted.	No. of grns. of calomel given in each dose.	Average amount for 24 hours of food and drink given *before* the experiment.	Average amount for 24 hours of food and drink given *after* the experiment.	Number of grains of diminution in the secretion of Bile after giving Calomel.			No. of grns. of increase of Bile Acids after giving Calomel.
					Fluid Bile.	Bile Solids.	Bile Acids.	
1	2 days before and 2 days after giving calomel, therefore 96 hours	3	4061 grns. of boiled ox-liver, 18½ oz. of milk, and 6¼ oz. of water	1675 grns. of boiled ox-liver, 14½ oz. of milk, and 7¾ oz. of water	602·605	33·940	6·634	
2	1 day before and 1 day after giving calomel, therefore 48 hours	6	3146 grns. of boiled ox-liver, 18½ oz. of milk, and 8 oz. of water	No meat, 12 oz of milk, and 13 oz. of water	1121·268	35·419	2·076	
3	2 days before and 2 days after giving the calomel, therefore 96 hours	10	7000 grns. of boiled ox-lung, 18¼ oz. of milk	6500 grns. of boiled ox-lung, and 11½ oz. of milk	323·919	3·815	—	8·697
4	2 days before and 2 days after giving the calomel, therefore 96 hours	12	7000 grns. of boiled ox-lung, and 17¾ oz. of milk	7000 grns. of boiled ox-lung, and 11¼ oz. of milk	933·650	32·094	11·476	

All the above four experiments with calomel give one result, viz., *a diminution in the amount of fluid bile and bile-solids secreted after the administration of large doses of calomel.*

In the first two, particularly in the second, the decrease was no doubt due somewhat to the diminished quantity of food taken the day after the calomel was given; but that it was not all dependent upon this cause seems to be pretty clear,—1stly., from the fact of the bile of 19th June, the day following that in which food and milk were purposely withheld from the dog, having been considerably greater than the quantity secreted on the day following the 16th June, when also no food was taken, and when in addition 6 grains of calomel had been administered to the dog; and 2ndly, from the bile in the last experiment, when almost exactly the same amount of nourishment had been consumed *after* as *before* the exhibition of calomel, having been also very much diminished in quantity. In three of the above experiments, the bile-acids were also considerably *diminished* after the calomel; but in one, viz., the third experiment, they were *increased.* Why the bile-acids should be increased in the latter case, and diminished in the other three, it must be confessed it is difficult to explain.

Although it would be rash to venture any decided opinion

from the very small number of experiments above detailed, yet the few that were made, all point so much to one conclusion that, if they be confirmed by future and more varied trials, they would throw considerable doubt upon the generally received opinion that calomel in large and purgative doses increases the flow of bile. It may be urged that although calomel does not increase the secretion of bile in the dog, that is no reason why it may not do so in man; and that, even if mercury do not excite the liver to increased secretion in a healthy state of the organ, it may still do so in certain diseased conditions of the same. If the first objection were true, the same could be brought against the results of the experiments which have been upon the lower animals to ascertain the action of poisons or, any other articles of the Materia Medica. With regard to the second objection, nothing analogous occurs in the action of drugs upon other organs; there is no medicine which diminishes the secretion of urine in the healthy state of the kidney, and increases the same in certain diseased conditions of the organ; there is no medicine which diminishes the amount of sweat in a healthy state of the skin, and acts as a diaphoretic in certain diseased conditions of the integument. Hence it seems difficult to suppose that anything which diminishes the flow of bile in a healthy condition of the liver, should increase the secretion of the same in a diseased state of that organ.

Whether it be the mere purgative effect of calomel which causes the diminution in the secretion of bile, or some specific action, further experiments must decide. Of course, it must be understood that the above remarks apply only to cases where *purgative* doses of calomel have been given. Whether small and frequent doses of calomel continued for a length of time, so as to produce the specific action of mercury upon the system, really augment the biliary secretion, is matter for further experiment.

The above analyses were made in the laboratory of Dr. Lionel Beale, to whose great kindness I am indebted for the opportunity of performing these experiments.

ON SOME POINTS IN THE ANATOMY OF THE KIDNEY OF MAN IN HEALTH AND DISEASE.

By Lionel S. Beale, M.B., F.R.S., &c.

I.

ON THE MATRIX.

PLATE XXII.

THE matrix of the kidney was originally described by Goodsir, in 1842, as a "fibro-cellular framework pervading every part of the gland," analagous to the capsule of Glisson of the liver.* Bowman, in his paper published in the same year, speaks of the matrix "as apparently homogeneous, but probably having a cellular structure," more abundant in the cones than in the cortical portion.† "In the medullary portion the tubes are imbedded in a firm granular substance, not hitherto described, but which resembles a blastema, and is probably composed of cells."‡ Dr. George Johnson describes the "*fibro-cellular* matrix" as existing throughout every part of the renal structure, and states that the best way of examining it is to macerate a section in water for a few minutes, "so as to wash away the tubes and Malpighian bodies. The matrix then appears in the form of a fibrous network. . . . . In some parts transverse sections of the tubes are seen, and in other instances a considerable length of tube appears uncovered by matrix; this tissue having been removed by the knife, while the tube itself has just escaped the section."§ Kölliker describes the matrix as a *stroma,* composed of a form of connective tissue, exhibiting a fibrous appearance, and containing many nuclei, which, in part, belong to the capillary vessels. Some of these nuclei appear to consist of oval spindle-shaped cells, which are probably the cells of development of elastic tissue. In his drawing, the whole space between the walls of two contiguous tubes is represented as being occupied with connective tissue, and no mention is made

* The existence of a fibrous meshwork in the liver has been discussed in "The Anatomy of the Liver," page 19.

† On the Structure and Use of the Malpighian Bodies of the Kidney. Phil. Trans., 1842.

‡ Article, "Mucous Membrane." Dr. Todd's Cyclopædia of Anatomy and Physiology, vol. iii., p. 498.

§ Article "Ren." Cyclopædia of Anatomy and Physiology.

of capillary vessels or their remains existing in this situation.* Gerlach gives a very similar drawing, but states that the fibrous appearance is not perfectly well defined. I may be permitted to remark incidentally that the drawings of the two last observers, stated to be magnified 350 times, are probably not magnified more than 100 diameters. The diameter of the meshes represented in these drawings is somewhat less than those shown in fig. 1, Plate XXII., which is magnified 130 times; the intervening vessels being fully distended with size. The fibrous matrix has been very lately delineated by Dr. Isaacs.† In one of his drawings sections of vessels are represented in the matrix (fig. 43, page 428), and the area of these vessels is much smaller than natural. In such a preparation it would be obviously quite impossible to obtain *only transverse* sections of the capillaries.

Dr. Isaacs states that he "found some sections free from any other tissue," but does not show how this was proved. From the nature of the parts one cannot conceive it possible to isolate *vessels, tubes,* and *fibrous matrix,* even supposing the latter to exist in very large quantity. He concludes that the fibrous matrix is composed of white fibrous tissue resembling that of tendon.

Such statements might be multiplied to a great extent, but it is not intended in the present paper to review the opinions of the different authorities who have written on the subject. Enough has been brought forward to show that many observers regard the existence of a fibrous tissue in the cortical portion of the kidney as certain, while others express themselves in doubt as to the presence of such a texture in this locality.

The matrix of the kidney has been described by some as a firm fibrous structure so distinct as to be very easily demonstrated, while other observers have failed to discover anything more than a transparent or granular material in small amount which intervenes between the walls of the capillaries and the uriniferous tubes.

There can, I think, be little doubt that many of the drawings of the fibrous matrix really represent sections of the uriniferous tubes and vessels, the walls of which, from being pressed together, give rise to the production of folds, which cause the lines figured as the "fibres" of the matrix.

To prove the existence of such a structure, one must be able

* *c,* "Stroma von Bindegewebe mit länglichen Kernen." Mikroskop. Anatomie. Band II., zweite Hälfte, s. 361.

† "Researches into the Structure and Physiology of the Kidney." Trans. of the New York Academy of Medicine, 1857.

to distinguish in the thin section, the walls of the uriniferous tubes, the vessels, and the matrix in the interval. From the arrangement of the parts it is clearly quite impossible to separate the tubes and vessels entirely from the matrix, supposing it to exist. Another method would be to distend the vessels with plain size, some of which, permeating the capillary loops of the tuft would pass into the tubes. The size would prevent the collapse and folding of the sections of the delicate walls of the tubes and vessels, and the fibrous matrix, if there, should be evident. In such preparations although every tissue in the organ is very distinctly demonstrated, no texture to which the term matrix could be applied is to be seen.

The conclusions I have arrived at, from a careful investigation of this subject in several different ways, very nearly accord with those of Mr. Bowman. I have never been able to demonstrate any fibrous structure whatever between the vessels and tubes, nor have I succeeded in removing from a section the sections of the uriniferous tubes or capillary vessels. By soaking in water, the shrinking and crumpling which necessarily takes place in the membrane of the capillaries and tubes, gives rise to an indistinctly *fibrous appearance*, but this cannot be mistaken for a separate structure.

It would, I think, be more correct to speak of the contiguous surfaces of the vessels and tubes as being connected together by the intervention of a small quantity of a transparent and slightly granular material containing nuclei, the nature of which is not known, which had been hitherto described under the name of *matrix*. This so-called matrix, however, cannot be isolated, nor can it by any process at present known, be shown to be distinct from the vessels and uriniferous tubes, and therefore it is not a distinct structure, nor is it entitled to the name which has been bestowed upon it.

If the vessels of a healthy kidney be injected with perfectly clear size there is not the slightest appearance of any fibrous structure resembling that represented in the drawings of Johnson, Kölliker, Gerlach, Isaacs and others. The capillaries can be seen filled with the size, and in many situations the walls of the tubes can be demonstrated as well, but the whole appears perfectly clear and transparent. (Plate XXII, fig. 1.) If a little of the Prussian blue fluid* be added to the size so as just to give it a faint tint, the disposition of the capillaries can be made out more clearly. It is true that the tubes and vessels in the pyramids are separated from each other by a

* "Archives," No. I, page 18.

greater distance than in the cortical portion, probably in consequence of the walls of the tubes being firmer and thicker in the pyramid than in the cortical portion of the organ. This difference in the character of the tubular walls, harmonizes exactly with the different office they perform. In the cortical portion they are adapted for the free transudation of fluid, and their disposition of the tubes is such as to permit the fluid to remain a sufficient time to dissolve out any solid materials contained in the cells. In the pyramid, on the other hand, the channel is as wide as possible, the tubes are larger, and their walls so thick and firm as to ensure the existence of an open channel. It is obviously necessary that the tubes in this part of the kidney should be so firm as to prevent any chance of their walls becoming collapsed, so that the free passage of fluid along them would be interfered with.

The arrangement of the vessels in this portion of the kidney will be referred to in another communication.

The existence of a fibrous appearance in disease can scarcely be advanced as an argument for the presence of a fibrous matrix in the healthy organ viewed as an essential element of the gland structure. Many structures which are extremely thin, perfectly transparent and apparently structureless in health, become thick, more or less opaque, granular, or present a fibrous appearance in disease,—and the changes are at least as satisfactorily explained by supposing that an alteration has taken place in the walls of the capillaries or in those of the uriniferous tubes, or that the fibrous appearance is due to the exudation and subsequent condensation of a new material between them, as by attributing them to the hypertrophy of a structure which is supposed to be present in the healthy organ.

Upon considering the nature of the structures of which the kidney is composed it seems hardly likely that a fibrous matrix would be interposed between the walls of the vessel and that of the secreting portion of the uriniferous tube. Such a structure would interfere with the free transudation of fluid from the vessel into the tube; it would increase the distance between the secreting cell and the substances to be absorbed by it, while it could hardly contribute to the "*support*" of a system of tubes lying in immediate contact, or at most only separated in certain parts of their course, by a very slight interval. In such compact organs as the kidney and liver, the essential structures mutually contribute to each other's support, while the passage of the blood through the vessels keeps these delicate tubes in proper relation with the secreting elements of the gland structure.

The minute structure of the hard tissue between the tubes and vessels of the pyramids of the kidney will be delineated in another plate. The conclusions arrived at in the present communication may be summed up as follows:—

1. In the cortical portion of the kidney there is no evidence of the existence of a "*fibro-cellular matrix.*"

2. The fibrous appearance observed in thin sections of the kidney which have been immersed in water is due to a crumpled, creased, and collapsed state of the membranous walls of the secreting tubes and capillary vessels.

3. A small quantity of a transparent and faintly granular material, with distinct nuclei, the nature of which has not yet been determined, is to be demonstrated between the walls of the tubes and the capillary vessels.

4. The changes met with in disease can be fully explained without supposing the existence of a *fibrous matrix.*

(*To be continued.*)

PAPERS ON THE ANATOMY OF THE LIVER IN HEALTH AND DISEASE.

BY LIONEL S. BEALE, M.B., F.R.S.

VIII.

ON CONGESTION.

PLATE XXIII.

IF sections of different livers be subjected to examination, great variety in colour and differences in the arrangement of the ultimate gland structure will be observed, and, as is well known, the peculiar appearances familiar to anatomists are not confined to livers which are obviously diseased, but the character of sections of liver removed from the bodies of persons, killed suddenly in a state of health, varies much in different cases. The peculiarities in colour are due partly to the presence of blood in different parts of the capillary network, and partly to the state of the liver cells.

It is the object of the present communication to point out how some of these differences in colour in the human liver, so familiar to observers, are to be explained, to define their

nature, and to show how the precise locality of the alteration may be correctly ascertained.

Mr. Kiernan showed, long ago, that changes in the appearance of the lobules of the liver resulted from vascular turgescence, and the presence of an unusual amount of yellow colouring matter in the centre or circumference of the lobule.

"Sanguineous congestion of the liver is either general or partial. In general congestion the whole liver is of a red colour (Plate XXI, fig. 6), but the central portions of the lobules are usually of a deeper hue than the marginal portions. (Plate XXI, fig. 5). Partial congestion is of two kinds, hepatic-venous and portal-venous congestion. Of the first kind there are two stages. In the first and most common stage, the hepatic veins, their intralobular branches and the central portions of the plexuses are congested. The congested substance is in small isolated patches of a red colour, and occupying the centres of the lobules; it is medullary; the non-congested substance is of a yellowish white, yellow, or greenish colour, according to the quantity and quality of the bile it contains: it is continuous throughout the liver, and, forming the marginal portions of the lobules, is cortical. (Plate XXI, fig. 2). This is passive congestion of the liver; it is the usual and natural state of the organ after death, and probably arises from its double-venous circulation. In the second stage the congestion extends through the plexuses to those branches of the portal vein situated in the interlobular fissures, but not to those in the spaces, which, being larger than, and giving origin to, those in the fissures, are the last to be congested; when these vessels contain blood the congestion is general, and the whole liver is red. In this second stage the non-congested substance appears in isolated, circular, and ramous patches, in the centres of which the spaces and fissures are seen. (Plate XXI, fig. 3.) This is active congestion of the liver; it very commonly attends disease of the heart, and acute disease of the lung or pleura: the liver is larger than usual, in consequence of the quantity of blood it contains, and is frequently at the same time in a state of biliary congestion, which probably arises from the sanguineous congestion. Although, in the first stage, the central portions of the plexuses, and in the second, the greater portion of each plexus and those branches of the portal vein occupying the fissures, are congested, and although the plexuses are formed by the portal vein; yet, as this form of congestion commences in the hepatic veins, and extends towards the portal vein, and as it is necessary to distinguish this form from that commencing in the portal vein, the term of hepatic-venous congestion will not probably be deemed inapplicable to it. Portal-venous congestion is of very rare occurrence; I have seen it in children only. In this form, the congested substance never assumes the deep red colour which characterizes hepatic-venous congestion; the interlobular fissures and spaces, and the marginal portions of the lobules are of a deeper colour than usual; the congested substance is continuous and cortical, the non-congested substance being medullary and occupying the centres of the lobules. (Plate XXI, fig. 4). The second stage of hepatic-venous congestion, in which the congested substance appears, but is not, cortical, may be easily confounded with portal-venous congestion."—Phil. Trans. 1833.

Now, in practice, it is not so easy to point out the precise nature of the congestion as Kiernan's diagrams would indicate, for when a section of human liver is examined it is not possible to make out each individual lobule, so that the observer may say *this* is the circumference and *this* the centre. I have particularly dwelt upon the form of the lobules of the human liver elsewhere,* and have regarded the arrangement of the lobules

* On the Anatomy of the Liver, p. 13.

of the pig's liver as exceptional, and described their relation to each other as quite different from that existing in the human subject and in most mammalian and other animals. Mr. Kiernan's diagrams of the lobules precisely accord with those of the pig's liver, and the description which he gives of their arrangement, in which he is followed by numerous subsequent writers, accurately represents the condition in the pig, but not that in the human liver. The appearances delineated in his drawings of portal and hepatic venous congestion can never be demonstrated in the human subject, although they accurately indicate the appearance of a congested pig's liver.

Before Kiernan's time two substances were described as being present in a lobule of the liver, but this accurate observer showed that the difference of colour of different parts of the lobule was really dependent upon the presence or absence of blood in the capillaries.

In the human subject there is no distinct division between the lobules, and the capillaries of one, are, in the intervals between the branches of the vessels and duct, continuous with those of its neighbours. The vascular trunks are connected with the capillaries at tolerably regular intervals, and the position of these is sufficient to mark the form of the lobules and imperfectly to define the boundaries of each. Instead of the branches of the portal vein surrounding a circular or oval space, in the centre of which is the branch of the hepatic vein, these vessels seem rather to alternate with or fit into each other, always being separated by a definite interval of capillaries, which, however, varies in extent within certain limits.* Hence, in a section of human liver, it is sometimes difficult to decide which are minute branches of the portal and which those of the hepatic vein, unless the organ has been previously injected. The interlobular fissures can always be distinguished by the presence of the duct and artery, but in the smaller ones these are so small, and, when not containing blood, so transparent, that often they cannot be observed. In some sections the secreting structure radiates from the centre towards the circumference of the lobule, but in many preparations this is not to be observed. The point, however, is at once decided by injecting one of the large portal trunks in one part of the organ, and one of the hepatic veins in another part. The injection need only be very rough, and can be effected in the manner described in page 18, in a very few minutes. When such a specimen is examined with a low power the *portal* capillaries are seen to form a nearly uninterrupted network, the irregular spaces of

* Anatomy of the Liver. Fig. 2, *d*.

which correspond to the central part of the lobules where the branch of the hepatic vein is situated. The injected *hepatic* capillaries form spots surrounded everywhere by uninjected portions, unless the injection be pushed to a very considerable extent, when an appearance somewhat resembling that when the portal capillaries are injected results, but the injected portions are less regular in extent, and with a very little practice the eye can at once distinguish it. An injection of the artery alone will often serve to mark the circumference of the lobules. In studying the morbid changes of the liver it is absolutely necessary that no doubt should exist as to the precise seat of the alteration in question, and no pains must be spared to enable the observer to demonstrate conclusively the centre and circumference of the lobule.

The study of these changes has been rendered more difficult by the desire of various authorities, who have written on the subject, to assign definite names to changes, the extent of which cannot be precisely fixed, and thus the greatest confusion has arisen. It will be my endeavour to avoid using new terms, as far as possible, and I shall attempt to describe the changes as they may be seen, restricting myself to the names used by Mr. Kiernan. The state of nomenclature of morbid changes generally is so very unsatisfactory that I believe we shall advance more rapidly, and, without question, more safely, if we study the history of the changes, and give accurate drawings and descriptions, which, if true, must always be valuable, than by giving names, which will most certainly be altogether discarded or materially modified within a very short period of their introduction.

In health the blood flows perfectly freely from the branches of the portal vein through the capillaries of the lobule into the branches of the hepatic vein, but under certain circumstances, which will be considered in another communication, it is prone to accumulate, sometimes in the marginal and sometimes in the central capillaries of the lobule. The first has been spoken of as portal congestion—the second as hepatic-venous congestion. In the first condition, there is a retardation to the circulation through the lobular capillaries. In the second there is an obstruction to the escape of blood from the organ as it returns towards the heart. Sometimes the central parts of the lobule appear dark yellow, owing to the deposition of much colouring matter. This condition is termed biliary congestion, and, owing to the yellowish-brown colour of the central parts of the lobules and the altered condition of their circumference, a peculiar mottled appearance is produced, which is one of the

forms of what is termed *nutmeg liver*. Of this so-called nutmeg liver, however, there are many varieties produced in very different ways.*

In the present communication I shall only attempt to draw attention to a few of the appearances resulting from congestion, and determine the precise seat of the change.

With this view, I have carefully copied the appearance of a section of a healthy liver, in which the portal vein was injected blue and the hepatic vein red, but in each case the capillaries were only very slightly injected. Next, plans have been drawn to the same scale, and the vessels being in precisely the same situation in each, the different appearances produced by partial congestion of the lobule can be studied. The dark shading in the drawings indicates the congested portion. In Plate XXIII, fig. 1 is an accurate copy of a few lobules from a healthy human liver. The branches of the hepatic vein are slightly tinted. The capillaries are not injected. In fig. 4 the portal capillaries are congested. The small branches of the trunks of the portal vein are shown by the light spaces in the congested portion. Fig. 2 represents the central capillaries near the branches of the hepatic veins gorged with blood. The *outline* of the branches of the portal vein are alone shown. In fig. 3, the capillaries in the central parts of the lobule are supposed to be greatly distended with blood, so much so that at certain parts the congested centre of one lobule comes almost into contact with those of its neighbours. The general resemblance of this to fig. 4 cannot fail to be noticed, and in such a condition it would be very difficult to say which were the central and which the circumferential parts of the lobule. Nothing less than a very careful examination could determine this point, and the most sure way is to inject a branch of the portal vein or hepatic artery. The endeavour to illustrate the anatomy of the irregularly-shaped lobules of the human liver by comparing them with the nearly oval, regular, and well-defined lobules of the pig's liver has led to great inconvenience, and made the investigation of morbid changes in the liver appear more difficult than it really is. Morbid anatomists have not been sufficiently careful to fix with absolute certainty in the first instance the position of the centre and circumference of the lobules.

In fig. 5, the portal capillaries are represented as being partly filled with blood, while the central parts of the lobule are seen to be occupied with much yellow colouring matter.

* Some interesting observations on nutmeg liver have been made by Dr. Handfield Jones, and published in the Pathological Transactions, which will be again referred to.

Fig. 6, represents the arrangement of the vessels and capillaries of a single lobule of the human liver. These plans will serve to explain many appearances presented by actual specimens which will be alluded to in future communications.

(*To be continued.*)

RESULTS OF CHEMICAL AND MICROSCOPICAL EXAMINATION OF SOLID ORGANS AND SECRETIONS.

CASE OF MELANOTIC CANCER OF THE PENIS, LYMPHATIC GLANDS, AND OF THE THORACIC AND ABDOMINAL ORGANS.

By Charles Murchison, M.D., L.R.C.P.,

Assistant-Physician to King's College Hospital and to the London Fever Hospital.

PLATE XXIV.

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1. *History.*—James L——, aged 54, a butler, was admitted into the Royal Infirmary, Edinburgh, on February 4, 1851. He was a tall, robust man; his hair was dark brown, and his eyeballs were remarkable for their prominence, and for a bluish tint of the sclerotics. Attached to the lower and outer surface of the prepuce, and extending a considerable way along its free margin, there was a tumour, the size of a chesnut, of a dark brown, almost black colour, and with its surface nodulated and covered with a fetid, dirty yellow, puriform discharge. When pricked with a pin, it bled profusely, and it was often the seat of acute pain, especially during, and for a short time after, micturition. It had been growing for two years, and commenced as a small black wart on the outer surface of the prepuce, about an inch from its free margin; this wart for six months remained stationary, but afterwards increased more rapidly. On reflecting the prepuce, which was done with some difficulty, there were displayed on the surface of the glans several warty excrescences of a bluish black colour, and varying in size from that of a pin's head to that of half a pea. (Plate XXIV, fig. 1.) In each groin, there was a swelling the size of a hen's egg, which had first appeared about three months before admission.

On February 20th, the patient first complained of dyspnœa and cough; and stated that for two or three months his breathing had been more difficult than it used to be, though never to such an extent, as to give him very great uneasiness. On examining the chest, the left side presented a uniform bulging, measuring fully one inch more in circumference than the right. There was

also on this side marked dulness on percussion, very imperfect expansion, and complete absence of the natural respiratory murmur and of vocal thrill. The apex of the heart could be felt close to the left margin of the sternum. The right side was resonant on percussion, with puerile respiration, and a few moist and dry râles. Pulse ninety and very feeble.

After this, the patient got rapidly worse, he lost all relish for food. and became very prostrate. The fits of dyspnœa increased in frequency and in severity, lasting sometimes for several hours, and dulness with suppression of the respiratory murmur were observed over the base of the right lung. The tumour on the penis and the swellings in the groins increased slightly in size.

On the morning of March 26th, he had an unusually severe attack of dyspnœa; the pulse was 84, and almost imperceptible; the extremities cold; face livid; and the eyeballs more prominent. On the 27th, these symptoms were still present, with the addition of tracheal râles, which terminated in death the same evening.

2. *Post-Mortem Examination* (March 29th).—Body pale, but scarcely emaciated; muscular system well developed; veins of lower extremities varicose.

Chest broad and expanded, and perceptibly fuller on left side. Left pleura distended as far as middle line in front, with several quarts of fluid highly tinged with blood, and black pigmentary matter, which pushed the apex of heart towards right side. Scattered over the whole of the parietal and pulmonary pleuræ, were masses of a dark deposit, varying in size from the smallest appreciable point to half an inch in diameter, and, for the most part, presenting a circular outline. The largest of these nodules projected about one-sixth of an inch from the surface of the pleura; the smallest were not appreciably elevated, presenting a punctiform appearance not unlike the shading of a chalk drawing. The larger nodules were almost perfectly black, while the punctiform deposit had a brownish black tint, tinged more or less with purple. Most of the nodules were covered by the epithelial layer of the pleura, but at the back part of the cavity, where they were confluent and aggregated into flattened masses, this membranous lining was at some places wanting, and the masses exhibited a pulpy irregular surface, and yielded on pressure a large quantity of dark juice very like liquid sepia. The left lung was completely compressed and carnified. At the reflection of the pleura from the root of the lung upon the ribs, there was a layer of recently extravasated blood, at some parts half an inch in thickness. Right pleura contained a few ounces of fluid similar to that in left, and its surface exhibited nodules of deposit of the same character, but much less extensive. Imbedded in the substance of the right lung, were a few circumscribed black nodules, the largest about the size of a cherry; around them, the pulmonary tissue was normal and crepitant. The bronchial glands were all black, but not much enlarged. In the posterior mediastinum, the glands were greatly enlarged, and a cluster of them, forming a mass the size of an orange, was situated in the angle of bifurcation of the trachea, in front of the œsophagus. The deep cervical glands contained black pigment.

Between the mucous and muscular coats of the œsophagus there were one or two rounded nodules, the size of a barley corn, containing black pigment; the rest of the alimentary canal and the mesenteric glands were normal. On the surface of the liver there were seen about a dozen nodules of the black deposit, about one-third of an inch in diameter; and on section of the organ several similar masses were found imbedded in the substance of the organ. The hepatic chain of glands was normal. In the spleen there was a single mass of black deposit, the size of a pea.

The kidneys contained in various parts of their cortical substance melanotic nodules, the size of a swan-shot. Between the muscular and mucous coats of the bladder and of the urethra, were a few black nodules the size of barley corns. The tumour on the penis was slightly ulcerated externally, and presented on section a smooth, black surface, yielding on section a copious inky juice. The lumbar, inguinal, and femoral glands, were enlarged and infiltrated with black matter; and some of them were entirely converted into a pulpy black fluid.

The lymphatics of the spermatic chord contained one or two small melanotic nodules.

Along the whole of the abdominal aorta, there was a chain of enlarged glands. Some of these exhibited, on section, a black pulpy mass, while others, which were but slightly enlarged, presented the normal glandular structure, with circumscribed brownish black points. The hypogastric and sacral lymphatics, normal.

3. *Chemical Examination of Melanotic Matter.*—The following analysis of the pigmentary matter was made by Dr. James Drummond:—

"It was insoluble in water, alcohol, and ether. When treated with hydrochloric, nitric, and sulphuric acids, it was dissolved; the solution being nearly colourless. When chlorine gas was passed through it, suspended in water, it was bleached to a certain extent, but not entirely. When boiled with potash, it dissolved, with disengagement of ammonia. The ultimate analysis yielded the following result:—

"Carbon	67·01
Hydrogen	6·45
Nitrogen	11·45
Oxygen..	8·36
Ash	6·73
	100·00

"The ash consisted, in great part, of peroxide of iron."

4. *Microscopic Examination of the Melanotic Deposit.*—When a drop of the dark juice from the tumour on the penis was subjected to a magnifying power of 215 diameters, it was found to contain a large quantity of granular matter of a sienna brown colour. The granules were solid and angular, and refracted the light strongly. Acetic acid produced no change upon them; but strong nitric acid rendered them much lighter. Mixed up with these granules were a few nucleated cells, having a circular or oval outline, and a diameter of about $\frac{1}{500}$ of an inch. Some of the cells were more elongated, and one or two exhibited a branched appearance. Most of them were loaded with the coloured granules, which quite obscured all appearance of a nucleus. In some of the cells, however, which contained little or none of the coloured granules, one and sometimes two, nuclei could be detected. These nuclei measured from $\frac{1}{2500}$ to $\frac{1}{2000}$ of an inch, and contained one or two distinct nucleoli. In addition to the cells and coloured granules, was a small quantity of greyish molecular matter (Plate XXIV., fig. 2). When a small particle of the tumour was torn out with needles and examined, it exhi-

bited a network of fine filamentous tissue, infiltrated through the meshes of which were the elements of the dark coloured juice just described.

The melanotic deposits in the pleura, lumbar and inguinal glands, were also subjected to careful microscopic examination, and were all found to possess a structure similar to that of the tumour on the penis. The nucleated cells, however, containing little pigment, were observed to be most abundant, where the morbid matter appeared to have been but recently deposited, as, for instance, in the brownish punctiform deposits in some of the glands along the aorta (fig. 3); whereas in those tissues, which seemed to be entirely converted into a black pulpy mass, nothing could be detected except pigment granules, either isolated or adhering in masses (fig. 4.).

Remarks.—The above was a good example of what at the present day is generally described as "melanotic cancer," containing the elementary structures of a medullary cancer, modified by the superaddition of a dark pigment.

The situation of the primary disease was rather an unusual one; although the tissue first attacked, viz., the skin, is generally the first to suffer, almost the only exception being when the disease commences in the choroid coat of the eye.

It is to be observed, that the pigment granules when viewed by transmitted light, were brown and not black, as they are generally said to be; they were also angular, and not rounded, as they have been described and figured by Mr. Paget.

It is also interesting to notice, that the patient's hair was dark brown. Melanosis in horses is almost exclusively confined to those of a grey colour, and always manifests itself first in those portions of the skin, which are dark coloured, as on the under surface of the tail, round the anus, and on the margins of the eyelids.

Much discussion has arisen, as to whether the disease, which is so common in horses, is the same as that which occurs in man. Microscopic examination shows little or no difference in their structure. In both, the brown colouring matter is first deposited from the blood in the interior of large nucleated cells. On the other hand, the history of melanotic disease in the horse, is less malignant, much less like that of a true cancer, than that of the melanosis of the human subject. Professor Dick, of Edinburgh, once amputated a horse's tail, as high up as its second vertebral segment, on account of a melanotic tumour weighing 56 lbs. avoirdupois. Although a large portion of the diseased tissue was still left in connection with the anus and croup, the incised surface healed, to all

appearances, in as short a time as an incision of similar extent would have done in completely healthy tissues.* Melanotic disease, both in the horse and in man, exhibits one character in common with, and even in a more marked degree than, cancer, viz., a tendency to multiply itself in different parts of the body through the lymphatic system. Yet even in man, and still less in the horse, it differs from cancer, in not attacking indiscriminately the tissues in the immediate neighbourhood of the primary disease, and in being less prone to softening and ulceration. Moreover, there appears to be almost a total absence of that cachectic condition, which is so characteristic of cancer. In the horse, it is said, that life is scarcely if at all shortened by its presence; and even in man, it only proves fatal by attacking, through the lymphatic system, organs of vital importance to the economy. In the case which I have described, the disease had existed for two years, without any emaciation or impairment of the patient's health or strength. The symptoms referable to the respiratory organs were the first signal of the presence of a mortal disease. On the whole, there seem reason to doubt, whether true melanosis is so intimately allied to cancer, as modern pathologists would lead us to believe†. In its pathological history it presents a striking contrast; while structurally, the presence of the peculiar pigment surely betokens a difference of vast importance.

TUMOR, RESEMBLING TUBERCLE IN STRUCTURE, IN THE EYEBALL—REMOVAL OF THE EYE—RECURRENCE OF THE GROWTH, AND REMOVAL OF THE CONTENTS OF THE ORBIT—SECOND RECURRENCE—DEATH AND POST-MORTEM EXAMINATION OF THE BRAIN.

By Edward Charles Hulme, F.R.C.S.,

Assistant-Surgeon to the Central London Ophthalmic Hospital, and Surgeon to the Blenheim Free Dispensary.

GEORGE ROBERTSON, aged two years, a remarkably fine healthy looking child, was brought by the mother to the Central London Ophthalmic Hospital, in November, 1857, for advice as to the state of the right eye. On admission, the widely dilated pupil, showing a bright yellow metallic reflection from the

* Edinburgh Monthly Journal of Medical Science, August 1851, page 191.
† Paget's Lectures on Surgical Pathology, vol. ii, page 483.

bottom of the eye, rendered it clear that a growth was forming in the fundus of the globe. The cornea and lens were clear, the sclerotic of a slightly leadened colour around the cornea, the conjunctiva but moderately congested, the eyeball itself hard and tense to the touch. The ophthalmoscope showed two or three large vessels passing across the growth transversely, as well as a distinct lobulated form to its anterior surface. The child was ordered iron, cod liver oil, with occasional mercurials, without any effect in arresting the disease, although the health of the child continued good. In January, 1858, fresh symptoms of irritation showed themselves; the growth began to increase rapidly, slight effusion of blood took place into the anterior chamber, and the left eye suffering sympathetically, Mr. Hulme removed the globe by Bonnet's operation, on the 11th January. No hemorrhage followed; the child left the hospital three days after, and before a week the parts had tolerably healed.

Dissection of the Eye.—On a vertical section of the eye being made, the humours escaped, the vitreous being quite fluid, and, together with the aqueous, presenting a bright yellow colour, to which the yellow reflection was owing. A mass of white, soft, cheesy consistence, thickly interspersed with earthy particles, filled nearly the whole of the posterior chamber of the eye, commencing at the entrance of the optic nerve, involving the whole of the retina, pushing forward the hyaloid membrane, and the contained fluid vitreous, and almost touching the posterior surface of the lens, which remained perfectly clear. Between the mass and the choroid a grumous looking fluid was effused. The choroid itself was perfect in its totality, deficient in pigment, and somewhat thickened, detached from the sclerotic, with a small deposit between its layers of about the size of the section of a pea. A deposit of lymph was observed on the ciliary muscle. The sclerotic was of normal thickness posteriorly, but somewhat thinned in front. The mass itself was *non*-vascular.

Microscopic Characters.—The growth consisted of small, oval, irregularly roundish, ill-developed, non-nucleated cells, of the average measurement of $\frac{1}{3000}$ inch. Their contents were granular, acetic acid showing no nuclei, but rendering their contents more clear. These cells exactly resembled tubercle corpuscles, and were considered to be of this nature by Dr. Beale. Some larger cells, also with granular contents, and much free granular matter. The cells were deposited free, no matrix being recognizable. The earthy particles consisted of phosphate of lime (amorphous), with a trace of carbonate. Numerous plates of cholesterine were also found. No trace of retinal structure could be detected. The optic nerve being divided close to the eyeball, its structure could hardly be ascertained.

Fig 27.

Small bodies resembling tubercle corpuscles from the eye × 215.

The child showed itself occasionally at the hospital, continuing well in health, till the beginning of April, when the growth evidently re-appearing, at the urgent request of the mother, Mr. Hulme removed the entire contents of the orbit on the 15th April. Some hemorrhage took place, but was controlled by cold and pressure, and the child made a rapid recovery from the effects of the operation.

The fungoid, vascular mass, which was removed, consisted of the muscular stump of the eyeball, with the lachrymal gland, &c., infiltrated with numerous small cells of the same microscopic structure as the growth in the eye. No earthy deposit was found, but in one portion of the stump around the optic nerve, which was submitted to the microscope, cells bearing a decided malignant character were clearly made out. Large ovoid, caudate cells of varying size, from $\frac{1}{700}$ to $\frac{1}{1000}$ inch, with nuclei and nucleoli rendered clear by acetic acid, showed the evident nature of their current growth.

The child's health was evidently benefited after this operation for a time. Soon, however, a fresh development of the growth made its reappearance, which rapidly filled the orbit, and finally extended to the size of a small orange beyond the lids. The child quickly lost flesh, and, after a fortnight, during the greater part of which time it suffered from frequent convulsions, it died comatose on the 27th July.

Examination of the Brain.—Sixteen hours after death.—On opening the skull the sinuses of the dura mater were natural, the membranes of the brain and the brain itself were of natural vascularity and consistency; on slicing the brain from above down to the ventricles, they were found to contain more fluid than normal, and of a reddish colour. On raising the brain from the base of skull, it was adherent to the dura mater to about the extent of two inches around the optic foramen, there also the dura mater was more adherent to the bone than usual. A large, distinctly defined tumor, of the size of a hen's egg, was seen, communicating with the contents of the orbit, and pressing by its upper surface on the under part of the anterior and middle lobe of the brain, with which it had no connection, being separated from the substance of the brain by the membranes, and their enlarged and somewhat engorged vessels. The optic nerve was entirely destroyed by the pressure of the tumor, which was clearly continuous with its substance, but from the commissure back to the optic thalamus its course was clear. The optic thalami on both sides, as well as the optic nerve on the left side were quite healthy. The morbid growth itself was of a dirty white colour, of a soft, pulpy, almost pulverulent consistence, nonvascular, smooth on its surface, and although friable, it was easily detached from its position by the handle of the scalpel without any laceration. It was thickly interspersed throughout its whole substance with the earthy particles of phosphate of lime, and in its microscopic structure exactly coincides with the characters of the growth within the eyeball above described, with which it is undoubtedly similar.

Consideration of the above case seems to me to bear out the remarks of Sichel (Icon Ophthal. p. 563) on Cancer and Encephaloid of the Retina, viz., "That the characters of encephaloid of the retina are much more easy to recognise with the naked eye than by the microscope, and that the cancer cell in this affection seems easily to undergo modifications which mask its nature." The structure of the morbid growth of the eyeball I have above described, certainly shows no similarity to the structure of that kind of cell-growth which we are accustomed to call encephaloid, and although I removed the eye as early as possible, even before the lens had become opaque, and before the growth had reached its posterior surface, with the conviction that should it be a malignant growth, it would have

its origin in the optic nerve and retina, and thus early operation would give the patient a chance, yet when I submitted a portion to the microscope, the structure showed more like a tuberculous or strumous than an encephaloid deposit. In this opinion Dr. Beale and Mr. Taylor agree with me. The question as to whether it might be encephaloid in an atrophic or degenerating state seemed to be contradicted by its rapid growth, and this negative would seem confirmed by the subsequent examination of the brain, which is evidently the same disease, extending along the optic nerve, and which must have been in a state of rapid development, as the brain symptoms of which the patient died were merely of a fortnight's duration. M. Sichel has described in his above-quoted work (p. 582) an affection of the globe similar in many points to the disease above described, which he called "Pseud-encephaloid of the Retina," and M. Ch. Robin has examined and reported micrographically on an eye which M. Sichel removed from a child two years old. Plates are given of the microscopic structure (pl. 65, op. cit.). In this case M. Robin considers the disease to consist of an hypertrophy of the "Myélocytes anatomical elements of the grey substance of the encephalo-rachidian system, especially in the cerebellum, in contact with the white substance, near the surface, where these elements abound, as well as in the second layer or the layer of the nuclei of the retina." This layer is the same as that described by Mr. Bowman as the "granular layer." The hypergenesis of these elements, M. Robin considers, form certain tumors of the brain, often taken for cancerous, tuberculous, or fibroplastic, and also affect the retina, without affecting the other membranes of the eye. M. Robin's report and his drawings coincide so with the case I have given above, with the exception that I have been unable to trace any retinal structure, that I cannot but imagine the same disease has occurred to us both. M. Robin denies the existence of cancer of the retina, and establishes the above as a new form of disease. Unfortunately the fate of the patient is not recorded, and although the opinion of so eminent a pathologist and microscopist as M. Robin is entitled to all consideration, practically speaking, the disease in the eye runs the same course, most probably, therefore, it would turn out to be malignant.

As the notes of my case were taken before I had the opportunity of seeing M. Sichel's work, I have thought it worth while drawing attention to the similarity of the two cases, especially as I have been able to follow out mine to its fatal termination. As regards the decided encephaloid cells found in

the recurrent orbital growth in the tissues around the stump, I think M. Sichel's explanation of these cases is likely to prove correct, viz., "Many cases of retinal encephaloid observed by me prove that the disease takes its origin in the nervous pulp, and that when it invades the cellular tissue, the muscles, and the fibrous tissues, it then produces schirrus more or less soft."

ON THE STRUCTURE OF THE FALSE MEMBRANE IN SOME CASES OF DIPTHERIA.

By Lionel S. Beale, M.B., F.R.S.

THERE exists much difference of opinion with regard to the nature of the false membrane effused on the fauces in cases of Diptheria. Some observers regard it as an exudation from the vessels of the mucous membrane while others consider that its presence depends upon the growth of a fungus. Of late I have had many opportunities of subjecting portions of the false membrane to microscopical examination when quite fresh. Several specimens have been sent to me by my friend

Fig. 28.

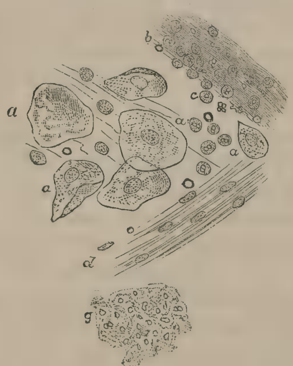
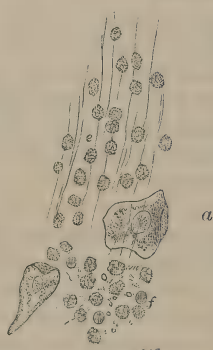


Fig. 29.



1000ths | | | | | × 215.

False membrane, from cases of diptherite.

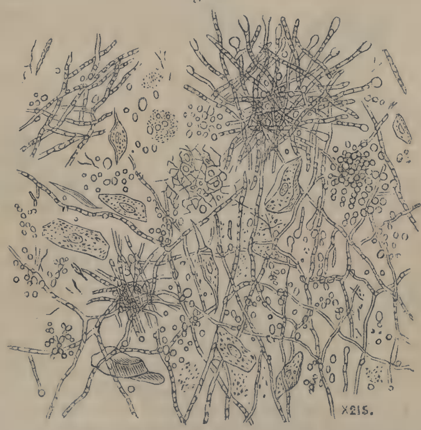
Fig. 28.—From the throat of a gentleman about forty, on the fourth day of the disease. *a*. Epithelial cells from the mucous membrane of the mouth. *b*. Portion of false membrane exhibiting a striated appearance and entangling numerous cells resembling pus corpuscles. *c*. Cells like pus corpuscles, showing nuclei very distinct. *d*. Another part of the false membrane stretched somewhat and entangling corpuscles rendered oval by the pressure.

Fig. 29.—From another case on the fourth day. *e*. Granular cells more disintegrated than those represented at *c*, and not exhibiting nuclei. *f*. Blood corpuscles. *g*. A portion of the mass entangling granular cells acted upon by acetic acid. No envelope is to be detected as would have been seen in the case of the pus corpuscle, but here it has been dissolved by the acid.

Mr. Spratly, assistant to Mr. Woody, of Tamworth. In these I have never been able to detect vegetable organisms, except in one case, in which they were certainly of extraneous origin. The characters of the membrane, however, differed somewhat in different cases. In some it appeared delicately fibrillated in its whole thickness, and contained a number of small faintly granular corpuscles. In others the mass appeared to be entirely composed of the small granular cells which agreed in their character with pus corpuscles, and in some instances two or three little bodies appeared in the corpuscle upon the addition of acetic acid. Figs. 28 and 29 give a very good idea of the general character of the false membrane. The relative proportion of the fibrillated material and the corpuscles varies in different cases and in different parts of the same specimen. More or less squamous epithelium is always entangled in the membranous mass.

The firmness of the membrane is due to the fibrillated substance which does not split into distinct fibres, but exhibits a number of lines or creases. It somewhat resembles the fibrillation of mucus, but the latter is more transparent and has less of the fibrous appearance about it.

Fig. 30.



Fungi in various stages of growth, with epithelium of the mouth, expectorated by a patient in the last stage of phthisis, × 215.

I do not doubt the assertions of many observers who have found vegetable organism in the false membrane. Doubtless this is a nidus favorable to the development of low forms of cryptogamia, and especially in cases where the membrane has been retained for some days within the mouth one would expect to find them. But there are many cases of true diptheria with an abundant exudation of false membrane in which not a single specimen of fungus is to be seen, and therefore fungi are not *essential* agents in the disease. On the other hand these vegetable growths are common enough in cases where there is no tendency to diptheria. In health amongst the ragged epithelium at the back of the dorsum of the tongue and in the tartar of the teeth numerous minute filaments of algæ or fungi (*Leptothrix buccalis*) are to be found.

The fatty matter secreted by the follicles of the tonsils always contain fungi. In apthæ these vegetable growths are abundant, and much of the whitish matter seems to consist entirely of vegetable parasites and their spores (fig. 30). Especially in low conditions of the system, when small apthous ulcerations are prone to form about the mouth, collections of fungi are observed. Such growths have always been common, but of late in consequence of the more frequent microscopical examination of adventitious matter found about the mouth, more attention has been paid to their presence, and their connection with diptheria has been inferred rather than proved. The microscopical characters of fungi from apthous sores is very well represented in fig. 30, which was taken from a specimen sent to me by my friend Dr. Scott Alison. It was expectorated by a patient in the last stage of phthisis and was derived from the mouth.

Fig. 31.

Cast of the uvula and structure of the false membrane, containing numerous minute cells, *b*, and exhibiting here and there a fibrillated appearance, *a*.

Fig. 31 is a copy of a very interesting specimen sent to me by Mr. Spratly. It represents an entire cast of the uvula of a child suffering from diptheria. I have preserved the specimen. Its microscopical characters are shown in the figure.

There were no true fibres, but merely an indication of fibrillation in a definite direction. Mr. Spratly sends the following notes of this case.

Case.—John Wilcox, aged three years, the child of a tripedresser and pork butcher, living in a badly drained unhealthy part of Tamworth. No outlet at the back, except a small yard, which contains three or four pigsties, placed under the bed-room window where the child was in the habit of sleeping, the smell from which is truly disgusting, much heightened by their mode of feeding t e pigs, which consists of the boiled entrails of other animals.

The child in question was seized (October 5th) with slight shivering-headache, pain in the limbs, (cried if they were touched) followed by slight general pyrexia, difficulty of swallowing, and slight stridulous breathing, the fauces swollen, of a dusky red hue and covered with flakes of membrane, which gradually increased in spite of the treatment.

An emetic brought away some of the membrane, and more was removed with the handle of a teaspoon, with great relief to the child. But he soon relapsed into his former state, swelling of the throat, great difficulty of deglutition, complete aphonia. A pale exsanguine condition of countenance, rapid depression of the vital powers. Death took place (October 10th, five days after he was first seized) by exhaustion.

SUGAR DETECTED IN THE LIVER OF A DIABETIC PATIENT, EXAMINED THIRTY HOURS AFTER DEATH.

Reported by A. B. Duffin, M.D.
House Physician to King's College Hospital.

CASE.—Richard Jerrett, aged 37, a sailor, admitted into King's College Hospital, under the care of Dr. Todd, May 29, 1858. Had lived during the previous autumn for three months on tainted meat. He afterwards (about seven months before admission) began to pass large quantities of clear, light-coloured urine, and to suffer from thirst and great hunger.

On admission, the sp. gr. of the urine was 1031. Trommer's test gave evidence of the extensive presence of sugar. No pulmonary cardiac or other complication to be discovered.

June 7th.—Had rigors, followed by profuse sweating. He then stated that when about 9 years of age he had suffered from ague for 13 months. His pulse rose from 80 on the 6th to 104 on the 7th inst. The attack lasted about two hours.

9th.—A fresh paroxysm of rigor, followed by heat and sweating. The pulse and breathing, which had fallen on the 8th to their usual rate (80–20) have risen to 104–33. This attack more protracted than the former one. It was noticed that his urine had decreased from 240 ounces to 220 ounces in the 24 hours. He was ordered gx of quinine.

10th.—Vomiting and loss of appetite now supervened. The sp. gr. of the urine fell from 1031–1020. It only gave evidence of a trace of sugar. At 5 p.m. he began to get torpid. At 8 p.m. he had a very small pulse of 120, his breathing was slightly accelerated, and he had only passed O ss. of urine since 12 o'clock. There was decided evidence of the presence of sugar, but to a much diminished extent. Ordered to abandon the meat diet, of which he had been till then partaking, and to take as many oranges as he could eat, ℥ss. of brandy every hour, and acetate, and aromatic spirits, of ammonia.

He became gradually more and more torpid, until at last he sank into complete coma, and died at 4 a.m. on the morning of the 11th.

P.M.—The body was well covered with fat; muscles well developed. Lungs much congested, but universally crepitant. No tubercule. Brain weighed Lbiij. ℥ij., substance firm; a little fluid in the lateral ventricles. Anterior pyramids readily separable from the restiform bodies. The whole of the medulla oblongata somewhat shrunk. Crura cerebri hard and dry. Numerous bloody points in the substance of the hemispheres. The fluids of the ventricles, arachnoid space, and pericardium were not found to give evidence of the existence of sugar in them. The blood, however, gave marked reaction to the tests employed to eliminate this substance. The kidneys were of normal size and appearance to the naked eye, and revealed to the microscope an opaque, granular condition of the tubular epithelium, the field clearing somewhat on the addition of ether; congestion of the Malpighian corpuscles. The spleen, large and flabby, weighed 4 pounds.

Examination of the blood.—Rather less than an ounce of the blood was evaporated to dryness over the water bath. The dry residue was extracted with boiling water and filtered. The

filtrate, upon being treated with Barreswil's solution, gave no indication whatever of the presence of sugar.

Examination of the liver.—About the same quantity of the liver pulp was treated in precisely the same way. The aqueous solution, when mixed with Barreswil's solution, and warmed, yielded an abundant precipitate of the suboxide of copper, showing the presence of sugar in large quantity.—[Ed.]

BLOOD CALCULI IN A WASTED KIDNEY.

By J. Scott Alison, M.D.,
Assistant Physician to the Consumption Hospital, Brompton.

In examining the body of a man, named William Solly, who was admitted into the Consumption Hospital, Brompton, under the care of Dr. Cursham, on the 23rd August, and who died on the 30th of the same month, the left kidney was found to be greatly atrophied, changed in structure, and to have the infundibula and pelvis stuffed with hard bodies, most of which were of a coal-black colour.* The black calculi occupied the pelvis, while the infundibula were tenanted with a few calculi of a whitish grey colour, with one exception small in size, about the magnitude of pear-seeds, and wanting the ordinary physical characters of phosphate of lime. One calculus, which occupied an infundibulum, is the size of a horse-bean, looks somewhat worn and disintegrated, and at one point resembles a piece of decayed wood. At one side it is black from the presence of altered blood. It is very light in weight, and is composed of blood and phosphate of lime. The black calculi, which form the chief point of interest in the case, were about six in number, and ranged from the size of a coriander-seed to that of a small horse-bean. When found, these black calculi were tolerably hard, but, being friable, they partly broke asunder in handling. The fractured surface varied a little in colour, in some parts presenting a dark rusty tint. As they are now preserved, they seem to be entitled, by their firmness and outline, to the title of calculi, and from their composition to the additional one of *blood* calculi. The colour is exactly that of blood which has been long coagulated and preserved in the body. Liquor

* The drawings accompanying this paper have been postponed. They will be published in No IV.—[Ed.]

ammonia dissolves them; they are capable of partial combustion. The microscope has revealed to my own eye only amorphous particles, but Dr. Owen Rees informs me that, with the assistance of a neutral saline solution, he has discovered forms which he believes to be remains of blood corpuscles.

The larger figure represents the large grey and black calculus, composed of phosphate of lime and blood; all the other figures represent the *pure* blood calculi. The very small, firm, and sandstone-like fragmentary calculi found in the infundibula are not represented: these were altogether dissolved by hydrochloric acid without effervescence.

The kidney is remarkably altered, and may deserve a little notice. It is very diminutive, but retains somewhat of the normal shape or outline. It weighs only $1\frac{1}{2}$ ounces, and is only two inches in length. Its colour is drab, its consistence is firm, and in this particular the kidney resembles a fibrous tumour. At one extremity only, and that over a very small area, can any natural cortical or tubular structure be found. The organ partakes much of the character of a sac with thin irregular walls. The infundibula and pelvis are out of all proportion to the outer wall, and the infundibula penetrate in many parts to within half a line of the external surface. The cones and papillæ are lost, and hard, irregular, fibrous-like structure forms the only remains of these parts. The lining membrane is healthy. The renal artery is small, thickened, and scarcely admits a common probe. The ureter is small, but less out of proportion than the artery. The investing membrane cannot be separated from the other parts with which it is assimilated. Under the microscope the solid parts of the kidney display only fibrous structure.

The right kidney was healthy, rather pale, and weighed $5\frac{1}{2}$ ounces.

The left lung weighed only a very few ounces, being little more than one vast cavity, with anfractuous walls, strongly adherent to the costal pleura. The contents of the cavity were a maroon-coloured mixture consisting of pus, mucus, tubercle blood and water.

The right lung was less perished, but throughout the whole upper lobe numerous white, firm, miliary tubercles, the size of pin heads, very thickly dotted the tissue. The right lower lobe was œdematous to a considerable extent.

The atrophy of the kidney in this case was probably brought about by the production of inflammatory action, set up perhaps by the presence of small calculi of phosphate of lime. Blood was probably effused in consequence, and from suppression of

urine, remained in the infundibula and pelvis, and failed to be washed down the ureter. This blood, hardening would form the calculi which were discovered. After the abatement of the supposed inflammatory action, degenerative processes would supervene, and lead to the remarkable atrophy and change which the kidney presents. The duties of this altered kidney would be thrown upon the other, but as the system was much wasted by disease, no increase of size would result

Only a very imperfect history of the patient could be obtained, he being very exhausted when he came into hospital. Since his death inquiries have been made for information, but with little success. He was 52 years old, and by trade a painter. He had been ill with cough 2 years, and his feet and legs became œdematous only two weeks previous to his decease. No information could be obtained respecting his having suffered from calculi in the bladder, or from hæmaturia, but it is right to mention that none of the family of the deceased could be found.

SMEGMA PREPUTII FROM A PATIENT WITH CONGENITAL PHYMOSIS,

REMOVED BY MR. J. D. BIRD, RICHMOND.

THE man from whom the five masses of preputial secretion had been removed was 28 years of age. The glans penis had never been uncovered. Five masses were removed by operation, the largest being about half an inch in length by a quarter of an inch in the two other directions.

Upon microscopical examination the hard white substance was found to consist of granular matter and epithelial debris, with a few epithelial cells, and many well formed crystals of cholesterine. The masses had the following chemical composition. 10 grs. were operated on

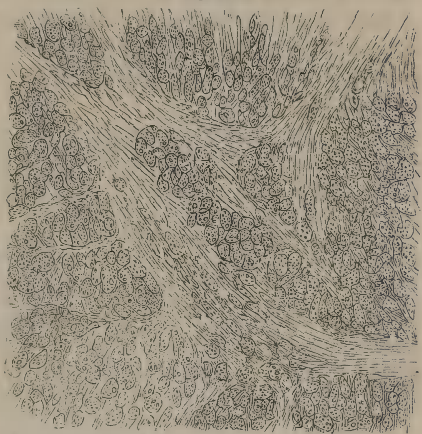
Water	7·46
Solid matter	2·54
Extractive soluble in alcohol and cholesterine	·24
Epithelium, &c.	2·02
Fixed salts	·28

THICKENING OF THE MUSCULAR TISSUE OF THE PYLORUS.

THE specimen from which the drawing was taken was sent to me by Dr. Hall, of Brighton. It was an excellent example of the morbid change which was formerly spoken of as scirrhus

of the pylorus. The patient had long been suffering from vomiting, and the rejected matters contained sarcinæ. The pyloric portion of the stomach was upwards of an inch in thickness, and cut almost like fibro-cartilage. The thickening was not confined to the pylorus, but extended for several inches towards the central part of the organ, becoming, however, gradually thinner. Upon examining sections made in various directions, the bundles of fibres of unstriped muscle were seen very distinctly. Although there can be little doubt that the change in question principally affected the contractile tissue, it is difficult to regard this merely as an hypertrophy of the muscular fibre cells. The muscular tissue is much altered in its appearance, and it is very doubtful if it possessed contractile power. So firm and thick a mass could hardly have been compressed to an extent sufficient to close the pylorus.—[Ed.]

Fig. 32.



Section of the thickened pylorus, showing bands of pale muscular fibres cut across, × 215.

VERY LARGE SPHERULES OF URATE OF SODA.

THE urinary deposit represented in figs. 1, 2, Plate XXV., was sent to me by Dr. Kennion, of Harrogate, who furnished the following note:—" The case was one of long continued bilious remittent fever, with occasional deposits of pus in the urine, which I had reason to believe was formed in the membranous portion of the urethra. I only noticed the large spherules of urate of soda on one (or at most two) occasions." The specimen also contained several uric acid crystals in the curious forms figured in Plate XIX., figs. 3 and 5, and numerous pus corpuscles. The spherules were readily dissolved by potash, and were soluble in the warm urine; but owing to the small quantity of the deposit, it was not possible to make a careful chemical analysis. The appearance of these curious crystals was not unlike that of *leucine*, but I am disposed to think they were composed of urate of soda. I have seen spherules of this substance very frequently, though I never met with such large ones as in the present specimen.—[Ed.]

CRYSTALS OF DIABETIC SUGAR FROM URINE.

THE beautiful crystals represented in Plate XXV., figs. 3 and 4, were sent to me by Dr. Gibb, who obtained them from the urine of a case under his care, by simply allowing a drop to evaporate spontaneously on a glass slide. Similar crystals were obtained from the tears. Dr. Gibb sends the following history:—

Case.—Mrs. Ann W——, a young married lady, aged 21, born of healthy parents, of a thin delicate frame, but healthy complexion, has been affected with diabetes mellitus for two years and a half, coming on immediately after weaning her only child, three years old. She first came under my care on 9th April, 1858, at which time she was extremely emaciated, and passed from 12 to 15 pints of urine in the 24 hours. Her thirst and hunger were very great. She drank on an average about eight pints of fluid in the 24 hours. The skin was dry and harsh, bowels costive, catamenia irregular for 18 months; tongue used to be cracked and furred, but was now clean and watery; legs ache very much, she can scarcely get up and down stairs; no cough; feels low-spirited, and cannot satisfy her hunger. The only point of importance in her early history is, that when a child a cup of boiling water fell on the top of her head. She was scalded, and ill for some time. The sp. gr. of the urine was 1040, highly saccharine, of a pale and clear colour. She was put upon an aloes and myrrh pill twice a day, and ordered a teaspoonful of the following mixture three times a day:—

Acidi Nitrici diluti	ʒiv
Tinct: Card: Comp:	ʒij
Syrupi Simplicis..	℥i
Aquæ	*ad* ℥vj ℳ

13*th.*—Very much better; walked a long distance to see me, without distress; less thirst, and less urine passed. Felt some slight burning, after the mixture, in the stomach, for an hour or so. This morning and last night drank nothing, only at her meals. Used to drink a gallon of water in the night alone. As the pills proved too laxative, one to be taken every two or three days.

Without giving the details of progress made from time to time, it will be sufficient to state that under this treatment, namely, the use of the dilute nitric acid mixture, the quantity of urine assumed its normal standard, and has remained so with scarcely an intermission to the present time, 5th October. Her skin became soft and moist, and she perspired freely during the warm weather. A general weakness of the eyes, with lachrymation, disappeared, although occasional dimness of vision is still present. Her appetite became moderate, and she digested her food well. Her strength improved, but her legs once in a while feel weak. The amenorrhœa has continued. Her nights occasionally were sleepless, but regulated by an occasional opium pill.

The sp. gr. of the urine has varied between 1040 and 1045, and remains still highly saccharine. This is the only unfavourable condition about her. It now is natural in quantity, from two to three pints in 24 hours, and her drink the usual quantity at her meals. I have clearly detected sugar in the saliva, and in the tears, and have allowed her to eat the most nourishing diet, with plenty of milk, and have not restricted her to any special alimentary treatment she has gained both flesh and strength.

BODIES MUCH RESEMBLING SPERMATOZOA IN THE URINE OF A WOMAN.

LAST July I received a specimen of urine from my friend Mr. Masters, which contained some very peculiar bodies, some of which might have been very easily mistaken for spermatozoa. Mr. Roberts kindly furnished me with the following particulars :

"The water you received was passed about 7 o'clock on the morning of the 28th. I first examined at 11 A.M., and found the 'bodies' the same in appearance and as numerous as at 2 P.M., of the same day. I found them in great numbers in the water on the 26th inst. After a long and careful search on the 29th, I could find only three or four specimens. Thinking they might possibly be formed out of the body, I kept this urine exposed to the air, and examined it after 10, and 24 hours, but could find none. I could find none on the 1st July."

Case—reported by Mr. Roberts.—Elizabeth Chandler, æt. 32, married ten months ago, admitted into St. George's Hospital, under Mr. Cæsar Hawkins, June 9th, for disease of the sacro-iliac synchondrosis on the left side.

History.—Nine months ago she first experienced pain in the back part of the left hip. She was told by her medical attendant that it was sciatica, and was treated for it, for about three months, when a small abscess which had been slowly forming over the sacrum burst, and has discharged sero-purulent fluid ever since. About two months ago her legs swelled a good deal. She has lost flesh very rapidly of late, and has been confined to bed for the last six weeks. *On admission* she was much emaciated, and the skin had a sallow cachetic appearance. There was no œdema of the legs. She complained of pain in and about the hip. There was a slight discharge from the wound over the sacrum. She was put on good diet, and bark and acid given. On the 23rd there was no discharge from the wound over the sacrum, otherwise much the same.

25th.—There was considerable prostration with frequent chills and flushes (probably hectic). No discharge from the wound. Six oz. of wine ordered.

26th.—Less prostration, and no shiverings. Wound quite healed. *T.* clean, *B.* open, *P.* 92, very small and feeble. Urine rather scanty; faintly acid, sp. gr. 1032, very turbid, presenting very much the appearance of *tea and milk.* On applying a gentle heat, it cleared very much, but an increased temperature rendered it almost solid. Nitric acid had the same effect. On microscopic examination, numerous granular and a few small waxy casts were observed, pus, epithelial and an almost infinite variety of other cells were seen. There were also some crystals of lithic acid, and an immense number of vibriones, and some bodies very much resembling spermatozoa.

27th.—Last evening she experienced a pricking sensation in the left foot, which was followed by sudden œdema of the whole leg, from the groin downwards. It was nearly twice the size of the other leg, and pitted easily on pressure.

28th.—The leg continues œdematous. Less pain in the hip—tenderness of the groin and thigh. Urine examined more carefully. Less turbid, and less albumen.

29th.—There is a profuse discharge of purulent matter from the wound over the sacrum. The œdematous leg is not so tense. *B.* relaxed. The nurse reports the motions healthy. No urine was saved.

30th —Urine rather freer—paler. After long and careful search, only three or four of the bodies resembling spermatozoa could be found three hours after the water was passed; numerous vibriones were observed. The water was allowed to stand exposed to the air for 10 and 24 hours, but none of the spermatozoa-like bodies could be detected.

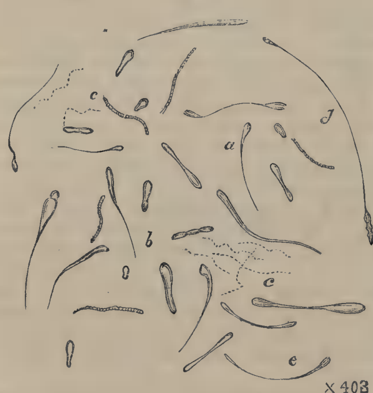
July 1st.—Much the same. Left leg still œdematous—wound discharging freely. Urine paler, clearer; numerous vibriones were observed in active motion

three hours after it was passed. None of the spermatozoid bodies could be found. The same variety of cells were observed, though in less number; there appeared to be somewhat less albumen.

On the 5th of July, she had symptoms of low peritonitis—diarrhœa—profuse discharge of pus from the opening over the sacrum. The leg continuing œdematous as before. The urine was examined directly after it was passed: it was acid—highly albuminous. Under the microscope, besides a great variety of cells, a considerable quantity of small fibrillæ were found, similar to those found on the 28th and other days, but none of them had the "*heads*" developed. I could detect no vibriones when first passed; but they were abundant two hours after. I thought that the fibrillæ were longer and more numerous; but this might be an error, as different drops were examined. It did not occur to me at the time to examine the same drop after being kept an hour or two. After this date the patient rapidly sunk from diarrhœa, sickness, suppuration, &c., and died in convulsions on the 9th of July. On examining the body after death, a large abscess was found occupying the venter of the left iliac bone. Extensive inflammation of the left iliac, femoral and saphenous veins existed, which explained the œdema of the left leg. The kidneys were large, pale, and smooth on the surface. The pelvis of the left kidney was rather large, and contained a quantity of urine, which, when examined by the microscope, was found to contain numerous fibrillæ, identical in appearance with those found in the urine before death. A small quantity of urine taken from the bladder presented the same appearance; the fibrillæ, however, appeared to be more broken up. In neither of the fluids could any of the spermatozoa-like bodies be found (i.e. the fibrillæ with "heads"). The mucus from the wall of the vagina and cavity of the uterus, I found to be perfectly healthy, as was that also taken from the walls of the bladder. All these organs were quite healthy. A section of the kidney presented the usual appearances of the "large pale kidney," and none of the fibrillæ, with or without heads, could be detected in the tubes by the microscope.

The bodies in question are represented in figure 33, which was copied with the aid of the neutral tint glass reflector. The engraving represents the appearance of these curious structures very accurately. The resemblance of many of the bodies to spermatozoa cannot fail to strike every one; but at the same time there are many forms which could not be mistaken for those bodies. I have copied in the drawing the principal forms I could find. In some the filament was very long indeed, while in other instances it was about the length of a spermatozoon. The thickened portion varied very much in form in different cases, and in some examples it was double. It is true that many of these bodies could not be mistaken for spermatozoa; but, on the other hand, there are some which could scarcely be

Fig. 33.



distinguished from them. I have never seen bodies precisely resembling these before, but have no doubt that they are forms of fungi. How and when they were developed must be regarded as uncertain. The importance of being aware of the existence of such bodies is very great with reference to the examination of the vaginal mucus in cases of rape. Although their presence is undoubtedly very rare, and a vast number of different forms were present, still in a cursory examination a mistake might be possible. At the same time, if three or four or more bodies agreeing in size, form, and refractive power, and resembling spermatozoa, are observed, I do not believe there can be any fallacy, and they must be spermatozoa. [Editor.]

ECHINOCOCCI HOOKLETS FOUND IN THE FLUID REMOVED FROM THE RIGHT SIDE OF THE CHEST OF A GIRL.

Reported by A. B. Duffin, M.D.
House Physician to King's College Hospital.

Case.—Susan Lazenburg, ætat. 23, was admitted into King's College Hospital, under the care of Dr. Todd, March 10th, 1858:—(twelve months previously she became cognisant of a bulging on the right side). On admission, the most dependent part of the liver was found at the umbilicus; the intercostals on the right side were bulged, but the intercostal muscles were still capable of approximating the ribs. A sense of great elasticity could be detected in the intercostal spaces. The heart was found to be displaced, its apex beating between the sixth and seventh ribs. The horizontal measurement of the right half of the thorax, at the point where the tumor was most prominent, extended $16\frac{5}{8}$ inches. [The Case-book *does not* contain any account of the direction of the hepatic lower margin at this time, neither are the state of the breathing, nor comparative measurement noted. No description is given of the upper limits of the tumor.]

March 17th.—Mr. Fergusson tapped the tumor between the sixth and seventh ribs, and removed Oiss of a limpid fluid. This was opalescent, sp. gr. 1011, of slight sickening odour. It contained phosphate of soda principally (proportion not stated), and traces of chloride of sodium. This was proved both chemically and microscopically. No trace of an echinococcus could be detected.

Some symptoms of constitutional irritation followed the operation. On the 18th instant, the measurements were: right transverse maximum circumference, $15\frac{9}{10}$ inches; left do. $15\frac{1}{5}$. Edge of liver midway between the ensiform cartilage and the umbilicus.

May 7th.—*Physical examination* right side. Dulness on percussion, *anteriorly* from the third rib to a line drawn midway between the sternum and the umbilicus. Between the second and third ribs percussion clear, above that point tympanitic. From the axilla the dulness extended vertically downwards as far as the apex of the tenth rib, and its lower margin was defined by a line drawn thence to the points midway between the sternum and umbilicus above mentioned. Posteriorly, percussion clear as far as a line drawn from the seventh dorsal spine, transversely from thence downwards, dulness. Over the left lung percussion quite clear everywhere. The position of the apex of the heart is slightly removed to the left, but the limits of the præcordial dulness so run over into those of the tumor that they cannot be accurately determined.

Measurement of right side of thorax, *a*, transverse. On the level of the fifth rib, $19\frac{1}{2}$ inches, from the vertebral spines to the centre of the sternum. An inch

below that point $16\frac{1}{4}$ inches. On a level with the apex of the second rib, $15\frac{1}{2}$ inches, corresponding measurements on left side, $15\frac{1}{2}$—$15\frac{1}{4}$, 15 inches.

Respiratory sounds.—Right side anteriorly, and above the third rib, puerile breathing, below this the breath sounds fade away, and are entirely lost opposite the sixth rib. Exaggerated vesicular breathing over the left side of the thorax. Inspiration on the right side causes the upper margin of the dulness to descend nearly three-quarters of an inch anteriorly. Posteriorly breathing is heard down to the ninth rib. Inspiration causes the limit of the dulness to descend one quarter of an inch. The cardiac sounds normally are propagated to a point four inches to the right of the sternum. A sense of great elasticity is to be detected laterally between the fifth, sixth, seventh, and eighth (?) intercostal spaces on the right side.

May 13th.—Mr. Ferguson again punctured the tumor between the fifth and sixth ribs laterally, about half an inch anterior to the site of the former puncture. The point of the trocar had to penetrate two inches deep before fluid was reached. About ℥ij of fluid escaped, which was handed over to Dr. Beale for investigation.

After a few weeks the patient went out, and since then nothing has been heard of her. The side was not perceptibly smaller.

Examination of the Fluid.—The fluid was perfectly clear, but of rather a dark brown color. Upon allowing a portion of it to stand for some time in a glass vessel, a small quantity of an amorphous deposit subsided. The microscopical characters of this deposit are represented in the accompanying woodcut. The large rounded masses seem to be of an oily nature. In general appearance, and in refractive power, they closely resemble a combination of fatty material with cholesterine, which I have met with on some occasions in examining livers, in which the biliary constituents have accumulated, in consequence of a physical impediment to the escape of bile from the duct. These masses also resemble the appearance of fatty matter from the brain. Besides these bodies, there were a few circular granular cells and *hooklets* of *echinococci*. Of the latter as many as seven were met with in examining two specimens of the deposit removed with a pipette.

Fig. 34.

a. Granular cells. *b* Claws of echinococci. The circular oil-like masses are made granular by acetic acid.

The specific gravity of the fluid was 1016·42; 1000 grains contained—

Water	948·80
Solid matter	51·20
Albumen	34·94
Extractives soluble in water	5·90
Alkaline salts	9·10
Earthy salts	1·26

PROCESSES AND INSTRUMENTS OF PRACTICAL VALUE IN CARRYING OUT SCIENTIFIC INQUIRIES BEARING UPON MEDICINE.

ON THE PRODUCTION AND IDENTIFICATION OF CRYSTALS OF ARSENIOUS ACID AND CRUSTS OF METALLIC ARSENIC.

By William A. Guy, M.B., Cantab.

Professor of Forensic Medicine, King's College, London; Physician to King's College Hospital, &c.

IN medico-legal analysis we often have occasion to procure crystals of arsenious acids and crusts of arsenic, as means of identification.

We employ the *crystals* for this purpose, 1. In examining a white powder, supposed to be arsenious acid; 2. In examining a green powder, supposed to be arsenite of copper; 3. In examining the metallic coating of the slip of copper foil used in Reinsch's process: and 4. As an additional means of identifying the metallic ring which lines the reduction-tube in the usual process of obtaining the metallic arsenic from arsenious acid or sesquious sulphuret of arsenic.

We make use of the crusts of arsenic in identifying the oxide and the sesquisulphuret; and we may use them for the same purpose in testing arsenic acid. Arsenite of copper, being more difficult of reduction, is best identified by the crystals of arsenious acid which it gives off when heated.

So that there are at least six processes in common use for medico-legal purposes into which the production and identification of crystals of arsenious acid and crusts of arsenic enter as a constituent. The subject, therefore, is of sufficient importance to justify an attempt to devise the best and simplest mode of obtaining the crystals and crusts in question.

The plan at present in use for these two purposes consists in introducing the substance or mixture to be tested into a reduction-tube about three inches long, of small bore (one-eighth of an inch diameter), sealed at one end; heating this sealed end with the flame of a spirit-lamp, and collecting the crystals or crusts on the cooler portion of the tube.

Several minute precautions have to be observed in applying this method. The substance to be examined must be so introduced as not to soil the sides of the tube; it ought also

to be free from moisture; and the tube itself has to be dried by applying the flame above the crust, and by the use of a roll of filtering paper; and care must be taken to apply the flame of the spirit-lamp in such a manner as not to drive any portion of the contents up into the higher parts of the tube. In reducing the metals also from mixtures of arsenical compounds with charcoal or black flux, we must either make use of German glass, or be prepared to distinguish the metal arsenic deposited on the tube from lead reduced in the glass itself.

But even when we have obtained on the sides of the tube sparkling crystals, or a crust of metal, we may have some difficulty in satisfying ourselves that the crystals are octahedra in the one case, or the crust a true metallic crust in the other. The crystals may be too small to allow us to ascertain their true form by the lens; and the shape of the surface on which they are deposited, though it does not preclude the use of the microscope, certainly renders it difficult and unsatisfactory. So also with the metallic crust. The quantity of the metal may be too small to yield, when driven up and down the tube, distinct crystals of arsenious acid, though the same quantity of metal on a flat surface would suffice for complete identification under the microscope. The same difficulty may arise if, instead of driving the metal up and down the tube, we file off its sealed end, break up the part which contains the crust, introduce the fragments into a second reduction-tube, and so endeavour to obtain octahedral crystals of arsenious acid.

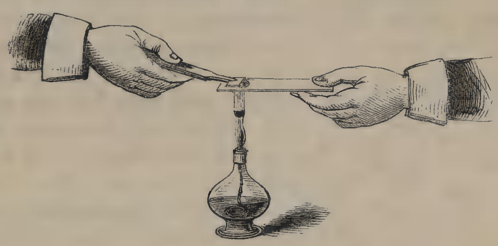
Now the method which I have for some time been in the habit of employing, and which I am now about to describe, is free from both these classes of objection, without being open, as far as I am aware, to any objections of its own. It does not require the delicate handling necessary for keeping the reduction-tube clean, and it offers great facilities for the identification of the crystals or crusts. The processes of reduction, and of conversion from metal into arsenious acid, take place in a tube used only for that purpose, and the deposit is received on a flat surface free from any admixture of extraneous matter, and affording complete facilities for microscopic examination.

The tube which I use is smaller than the smallest sized "specimen-tube" in common use, of larger bore than the reduction-tube commonly employed, and about three quarters of an inch in length. The tube is supported in a vertical position by being dropped into a hole punched in a slip of copper foil.*

* I have sometimes used a slab of porcelain, with a hole drilled in it; but am inclined to prefer the copper foil, partly as maintaining the temperature of the neck of the tube, and partly as free from the risk of fracture.

Into this short tube the powder or mixture is dropped. The tube suspended in this manner is held by the left hand with its sealed end in the point of the outer flame of the spirit-lamp, while a piece of clean microscopic glass, large enough to cover the mouth of the tube, is adjusted with the right hand. (See fig. 35). After a few seconds, the glass is covered with a circle of sparkling crystals, or with a distinct metallic crust, either of them in a state most favourable for further examination.

Fig. 35.



If the operator wishes to have both hands disengaged, a stage bearing the copper slip or porcelain slab is readily adapted to the spirit-lamp itself, or he may use a common retort-stand. In order to obtain satisfactory results by this method, no other precautions need be observed than to pass the microscopic glass through the flame of the lamp before adjusting it to the mouth of the tube, so as to dry and warm it, and to apply the point of the *outer* flame of the spirit-lamp steadily to the sealed end of the tube, the flame being of moderate size. A metallic crust obtained in this way may be proved to be arsenical by carefully cutting the microscopic glass with a fine pointed diamond into slips, introducing these slips into another specimen-tube, and converting the metal into arsenious acid by a repetition of the simple process just described.

Having now described the form of apparatus and simple method of procedure required for procuring crusts and crystals on a flat surface, I proceed to describe the new results obtained by this means, and to give a few examples in proof of the simplicity and delicacy of the method—examples which will serve of themselves to obviate the only objection to which the method might seem to be exposed.

As far as the crystals of arsenious acid are concerned, the advantage is limited to the greater ease with which the crystals can be examined and identified under the microscope. When we are dealing with a very small quantity of the acid, this advantage is a real one; for cases certainly do occur both in driving a small metallic crust up and down the old form of reduction-tube, and in identifying the coating of the slips of

copper used in Reinsch's method, where crystals which could not be identified either by lens or microscope on the inner surface of a small reduction-tube may be readily recognised on the flat surface of a piece of microscopic glass.

Although the form which crystals of arsenious acid present under the microscope is familiarly known, I append a woodcut, showing the appearance of a small group of them on a flat surface in a special case; and also, by way of contrast, a group of crystals of corrosive sublimate obtained in the same way. It is scarcely necessary to add that the crystals of corrosive sublimate never wear the dotted sparkling look of the crystals of arsenious acid, and that corrosive sublimate first melts, and further differs from arsenious acid in assuming much more generally an amorphous form of deposit.

Fig. 36.

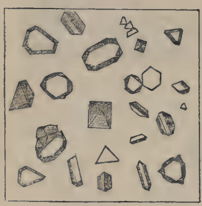
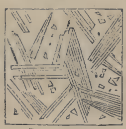


Fig. 37.



But it is in testing forarsenic by the process of reduction that the advantage of a flat surface for the deposit of the metallic crust chiefly displays itself; for not only does the thin glass coated with arsenic lend itself readily to the further process of identification by the formation of crystals of arsenious acid, but the metallic crusts themselves may often be recognised by distinctive characters when examined by the microscope.

To the naked eye the crusts of arsenic present different appearances, according to the quantity of metal present. The thinnest crusts are irridescent; those of somewhat greater thickness wear on both surfaces the smooth and uniform aspect of the crusts obtained by Marsh's method; and crusts consisting of a still larger quantity of the metal are often found to be made up of distinct flat patches of equal size and similar shape, separated by equal and similar intervals, and resting on a uniform thin ground, forming a pattern not unlike in shape, and sometimes even in colour, to the coat of the leopard. The thickest crusts of all have a distinct granular appearance on the surface of deposit; and it is these crusts that present under the microscope the characteristic appearances presently to be described.

In the colour of the spots obtained from the same compound of arsenic, and from the same mixture with charcoal or black flux, there is also much difference to be observed. Some of the spots have the hue of polished steel, others that of burnished copper; and a few have a dull yellow, orange, or claret colour. But they are all distinguished by continuity of surface, as seen by the naked eye, and by moderate firmness of adhesion.

The microscopic appearances presented by the thicker crusts are, as I have just stated, highly characteristic. When viewed by reflected light, they either present buff-coloured masses in strong relief on a ground of uniform tint and texture, some of these masses being distinctly octahedral; or the surface, though uneven, is less irregular, and consists of small bright spots, sometimes arranged in a zigzag pattern on a flat surface variously tinted, from which surface brilliant triangular facettes, and distinct transparent octahedra, project in large numbers, mixed with less regular shaped spots of blue, brown, gray, yellow, and red. The octahedra in the first variety seem to consist of arsenious acid tinted on the surface by a thin layer or powder of metal. In the second variety they evidently consist of arsenious acid which has escaped decomposition. These two crusts are depicted in figs. 38 and 39. The crusts just described and depicted are, it must be understood, obtained from arsenious acid reduced by charcoal; and they are, in every case, a mixture of the metal with its oxide. The appearance of the metal itself is, as I proceed to show, quite different, and such as even a practical chemist would not be prepared to expect. When the very same mixture of arsenious acid and charcoal is introduced into a specimen tube of the same kind, and covered with bicarbonate of soda, so that the vapour of the metal may be deposited unchanged in an atmosphere of carbonic acid gas, the resulting crust of pure unmixed metallic arsenic when examined by the microscope, is found to consist of distinct *globules* not distinguishable at the thin edges of the crust from globules of mercury, but distinguished in the thicker parts of the crust by resting on a ground of uniform colour and texture, sometimes gray, sometimes copper-coloured, sometimes of the two colours blended. Or, the crust is found to consist of patches approaching to the circular form, gray or copper-coloured, on a thinner ground, with nearly equal intervals between them, each small circular patch being fringed with globules of metal, dotted with single globules. Under the higher powers of the microscope, these thicker spots are themselves resolved into an aggregate of small globules. That these spots are globules, and not crystals, was clearly ascertained by the use both of transmitted and reflected light, and acknowledged after very cautious examination (for the appearance was quite unexpected) by my colleagues,

Fig. 38.

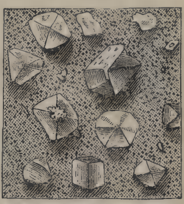
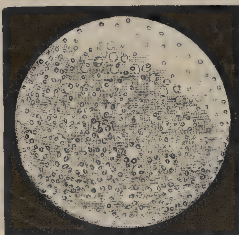


Fig. 39.

Professors Miller and Bloxam, and by Messrs. Hadow and Hardwich.*

The appearance now described is represented in the annexed woodcut, in which a portion of a crust is shown in a circular form. The darker portions of the figure represent the spots margined and dotted with globules; while the lighter portions show the globules scattered over the surface of the glass so as not to be distinguishable from the globules of mercury.

Fig. 40.



The unexpected appearances presented by a series of crusts of arsenic obtained in this manner led me to examine afresh under the microscope the crusts already described as consisting of the metal and its oxide; and I found them to consist in part of globules of metal, in part of crystals of the oxide. Out of a considerable number submitted to examination, there was not one which did not in some part or other exhibit the globules of metal. Some portions of some crusts, especially towards their margins, consisted of well defined octahedral crystals, blended with equally well defined globules, as is shown in fig. 41.

Fig. 41.

The globule, therefore, seemed to be as much the normal form of the elements of the metallic crust of arsenic as the octahedron of the deposit of arsenious acid; and it seemed quite clear that the compound crust obtained by reducing arsenic in contact with atmospheric air might be resolved into globules of metallic arsenic and crystals of arsenious acid, the globules having a tendency to assume the form of very minute globules in contact with the glass, with patches of dotted or beaded metal in slight relief adhering to the layer first deposited.

By procuring a series of crusts of different thickness, and submitting them to careful examination, I have come to the conclusion that the usual mode of formation of the unmixed arsenical crust is as follows:—The surface of the glass is first covered by a uniform layer of minute globules; upon this first layer the circular patches of larger globules, beaded at the edges with still larger ones, is superimposed; and if the process is continued, the globules in the thicker portions of the crust, and

* In this place I must acknowledge my obligations to Mr. Pizey, of King's College Laboratory, for the weighings of the arsenical crusts which he was good enough to make for me.

where the heat is greatest, run into each other, as is the case with globules of mercury. In fact, the globules of arsenic behave in every way as do those of mercury. They run together into larger masses, and they undergo the same change of shape when submitted to pressure. The only difference between them is in the temperature necessary to maintain them in a liquid state.

If this account of the unmixed crust of metallic arsenic be correct, it ought to be borne out by a microscopic examination of the crusts obtained by means of Marsh's apparatus. These crusts, as ordinarily obtained, are pure crusts of metallic arsenic, thicker in the centre than at the margin, and having in parts sufficient substance to admit of comparison with crusts obtained by reduction. Now, on submitting a series of these crusts deposited on a surface of white porcelain to microscopic examination, they were found to possess the characters just assigned to the crusts obtained by reduction with charcoal. Globules could be clearly detected in many parts of the crusts, and the same tendency to the arrangement in regular figures was observed. As, however, the identification of globules by reflected light is less easy and satisfactory than by transmitted light, I resorted to a simple plan, by which I succeeded in transferring the crust of arsenic in a modified form from the opaque porcelain to the transparent glass. I selected a crust of some thickness, and placed upon the porcelain a small square of glass about an eighth of an inch thick, with a circular hole in the centre (a piece of glass, in fact, used for making a microscopic cell), in such a manner as to surround and contain the crust of arsenic. Having passed a piece of microscopic glass through the flame of the spirit-lamp, I placed it over the perforated glass, so as to convert the whole into a species of short tube closed at the top and containing a crust of arsenic. On applying the flame of the spirit-lamp to the porcelain, the crust of arsenic was soon seen to disappear and to settle on the glass above. On removing the glass and examining the crust, it was found to be larger than that from which it was obtained, but thinner, of uniform thickness throughout, and of a copper colour. When placed under the microscope, it was found to consist wholly of globules of metallic arsenic in large numbers set close together. A second crust obtained in the same manner consisted mainly of globules, but in part also of well defined octahedra. It is evident that the short space thus interposed between the crust and the flat cover of glass does not contain enough air to oxidise any considerable portion of the metal; so that a metallic crust may thus be transferred unchanged, except

in size and thickness, from porcelain to glass; thus supplying, if it were needed, a fresh means of identifying as arsenic the crust obtained by Marsh's method.

The thicker crusts of arsenic described, and depicted in figs. 38 and 39, are, of course, sufficiently identified by the octahedra found upon their surface; and it is not necessary to resort to any further test. But the thinner crusts should be treated in the manner already recommended. The microscopic glass, cut with a fine-pointed diamond into slips of convenient width, is to be introduced into a second reduction-tube, the flame of the spirit-lamp again applied, and the crystals of arsenious acid collected on a second slip of thin glass, identified under the microscope. The thicker crusts, or portions of them, may be treated, if deemed desirable, in the same way.

That the simple method of procedure which I have now described has some advantages over the plan now in use there can be, I think, no reasonable doubt; but it may be objected to it with some show of reason, that it involves a waste of material. Some portion of the metal in the one case, and of the arsenious acid in the other, may be expected to escape between the mouth of the tube and the slip of microscopic glass, which escape is rendered impossible by the very length of the reduction-tube in common use, excepting always that escape of finely-divided particles of metal by which we are enabled to perceive the garlic odour during the operation of reduction.

This objection can have no place where we are dealing with large quantities (such as a grain or a large fraction of a grain) of arsenious acid, or of the compounds of arsenic, alone, or mixed with charcoal or black flux. It applies only when the quantity of the material to be operated on is very minute—say the hundredth of a grain. In the one case (where the quantity is large) the escape of a portion of it is of no moment; while in the other case (where the quantity is small) there is a probability in favour of its being entirely deposited on the flat surface, or partly on it and partly around the mouth of the tube. When the tube exceeds three-quarters of an inch in length, the crystals are apt to be thus deposited; but when the shorter tube is used, the deposit takes place wholly on the flat surface of glass.

To this account of the simple apparatus and method which I recommend, I will add a few examples in illustration of its delicacy, and as an answer to the objection, should it be urged, that the use of the short tube entails a waste of material. The examples are limited at present to the reconversion into

arsenious acid of the metallic crust obtained by the reduction of arsenious acid by charcoal.

Ex. 1. Into a tube an inch long, supported by a porcelain holder, I introduced the fragments of a small thin crust of arsenic, too thin to have any characteristic appearance under the microscope, and obtained a large crop of sparkling octahedra on the lip of the tube, and a thin continuous mist on the flat glass, which mist, when viewed by the lens, was found to consist of brilliant points, and under the microscope of well-defined octahedra. The tube in this experiment was obviously too long.

Ex. 2. I cut a small crust of arsenic, distinct but not granular, and presenting, like the last specimen, no characteristic appearance under the microscope, with a sharp-pointed diamond, into ten portions, which I introduced successively into a specimen tube three-quarters of an inch long. Each fragment of the crust yielded crystals of arsenious acid. In one instance, the heat was too great and too long continued, and part of the sparkling deposit could be seen to disappear from the glass before it was withdrawn.

Ex. 3. A slip of microscopic glass stained with a thin distinct crust of arsenic, resembling the foregoing, and, like them, obtained from arsenious acid by reduction with charcoal, was carefully weighed in an assay balance, and found to weigh 1·253 grains. It was cut into four pieces coated with about the same quantity of arsenic; and each piece was heated in a tube three-quarters of an inch long suspended by a metal holder. A mist of arsenious acid, the size of the mouth of the tube, was sublimed in each case. The fragments of glass thus free from crust were weighed again, and found to have lost ·010 of a grain. As, therefore, the entire crust weighed the hundredth part of a grain, each fourth part must have weighed a little more or a little less than the four-hundredth of a grain. The mists of arsenious acid when inspected by the lens were found to consist of sparkling points, which could be recognised as octahedral crystals by the microscope, a fourth power being sufficient for identification. Having selected one of these four discs of crystals, I contrived by very careful successive removals to divide it roughly into 500 parts, one of which remaining filled the field of the microscope, and contained, by rough estimate, at least 1,000 crystals. As the disc was equally covered throughout, it is probable that it contained at least 500,000 minute crystals, a large proportion recognisable as octahedra; and as this large number was obtained from a four-hundredth of a grain, it follows that a single grain of metallic

arsenic may be made to resolve itself into *two hundred millions* of distinct crystals.

Ex. 4. Four small slips of microscopic glass, each bearing a minute fragment of a crust of arsenic, were weighed in an assay balance, and found to weigh respectively 0·280, 0·230, 0·137, and 0·141 of a grain. The slips having been carefully heated in a small specimen tube three-quarters of an inch long, suspended in a metal holder, yielded distinct circular mists, and lost respectively 0·003, 0·003, 0·001, and 0·001 of a grain; so that two of the crusts weighed each the three hundred and thirtieth part of a grain, and each of the two remaining crusts the thousandth of a grain. Examined by the lens, all the mists were found to consist of brilliant detached points distributed evenly over the surface, which under the microscope could be readily identified as octahedra. Both the mists yielded by the thousandth of a grain could be easily resolved into octahedra under the eighth power of the microscope, and one of the two, by the successive removals just described, was found to consist of crystals which could not be less numerous than 250,000,000 to a grain of metallic arsenic—a number which I believe to be greatly under-estimated. Successive experiments with minute quantities of metal, apparently not exceeding the thousandth of a grain in weight, all yielded the same decisive result; so that I feel justified in stating that by this simple method a crust of less than the thousandth of a grain of metallic arsenic may be identified with ease and certainty.

I am not aware of any procedure at present in use which furnishes evidence of the nature of such minute fractions of a metallic crust. It is true that Christison (On Poisons, 4th edition, p. 258) says that "the characters of the crusts are distinct even in crusts weighing only a three-hundredth of a grain;" and Dr. Taylor (On Poisons, p. 337) "that by the reduction-process, distinct arsenical sublimates may be procured, weighing considerably less than the thousandth part of a grain;" but the procuring of a quarter of a million of distinct crystals of arsenious acid, recognisable by the microscope as octahedra, from the thousandth of a grain of metallic crust, by a simple and certain process, may, I believe lay claim to novelty.

Though the method I recommend is extremely easy of application, it may be well to describe it so that it may be followed with success. Having provided a portion of a metallic crust on a narrow slip of microscopic glass, a clean fragment of the same glass, and a clean tube of small bore, three-quarters of an inch long, pass the tube through a hole in a slip of brass or copper supported by a retort-holder. Adjust the tube at

such a height that the point of the outer flame of the spirit-lamp may touch the bottom of the tube. Heat the tube to expel the moisture which it contains. Allow it to cool, and then introduce the slip of glass bearing the metallic crust. Pass the piece of microscopic glass which is to receive the crystals through the flame of the spirit-lamp, so as to drive off its moisture; and place it carefully over the mouth of the tube. Bring the flame of the spirit-lamp to bear steadily on the sealed end of the tube, and watch narrowly both the crust inside and the thin glass above. As soon as the crust disappears from the glass within, and the cover displays either distinct crystalline points, or a mist, withdraw the spirit-lamp, and allow the glass to cool before removing it for examination. Follow the same instructions in the case of slips of copper-foil or copper gauze coated with arsenic by Reinsch's method.

It will be observed that I have limited myself in this essay somewhat strictly to the subjects indicated in its title; but it must be obvious that for practical purposes many collateral questions, such as the appearances presented by other metallic crusts, require to be carefully examined. These questions I must reserve for a future communication. But I must take this opportunity of saying a few words respecting a chemical test for the crusts of arsenic, to which I first invited attention in the pages of the *Medical Times*, July, 1847, and the value of which I have since that time had many opportunities of demonstrating. I mean the Sulphide of Ammonium. If, as I then stated, a drop of the sulphide containing a slight excess of sulphur, is applied to the crust of arsenic, as obtained by means of Marsh's apparatus, the arsenical crust is slowly and imperfectly dissolved, while that of antimony rapidly dwindles to a

Fig. 42.

Antimony Crust

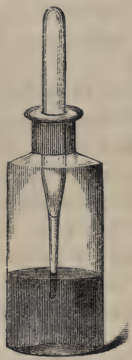
Fig. 43.

Arsenic Crust.

point and disappears; and further, that if the two crusts thus moistened are allowed to dry, the antimony crust assumes a rich orange tint without any trace of undissolved metal, while the arsenic crust displays a light lemon-yellow colour, chiefly at the borders, always blended in the centre with a larger or smaller portion of undissolved metal. As this test is equally applicable to the crusts of metal obtained by sublimation, I mention it

again in this place, and append coloured illustrations. But I revert to it also because the twofold nature of the test does not seem to be generally understood and appreciated. Dr. Taylor, for instance, in the appendix to his work on Poisons (p. 830), makes mention only of my suggestion 'that the mixture should be evaporated, when, if the stain be antimony, the residue will be orange-red: if arsenic, yellow;' and the test is mentioned in Bowman's "Practical Chemistry" (Professor Bloxam's edition, p. 103), as if it were only a test founded upon the different solubility of the two crusts. I am anxious, therefore, that it should be borne in mind that the test, as originally proposed by me, consists of two parts—the one founded on the very wide difference in the solubility of the two crusts; the other on the equally wide difference in the appearance of the dried residue. Though the matter is not of much importance, I believe that I may lay claim to such credit as attaches to having been the first to apply the sulphide of ammonium to this two-fold purpose. I may add that repeated experiment has proved the applicability of this test to crusts of every size, down to the smallest; provided the quantitity of the reagent be proportioned to the quantity of metal to be acted on. The antimony crust so treated is always completely dissolved, leaving an orange stain; the arsenic crust always imperfectly, leaving a lemon-yellow stain, spotted with undissolved metal. As it is not always practicable to regulate the quantity of sulphide of ammonium by the glass rod, I am in the habit of using and recommending, for all delicate purposes, a drop bottle of the kind figured in the annexed woodcut. It is not expensive, and combines the advantages of a stoppered bottle with those of a glass-rod capable of applying small and measured quantities of liquid, and used only for one re-agent.*

Fig. 44.



The thicker crusts of metallic arsenic, it may be well to add, are very readily dissolved by a solution of chloride of lime; so that the two best means of discrimination between the crusts of arsenic and antimony, as obtained by Marsh's method, are equally applicable to the identification of the pure metallic crusts of arsenic procured by the other methods of reduction.

I shall now bring this paper to a close by stating, in

* These drop-bottles are manufactured by the Messrs. Powell, of White Friars, and may be had, with the specimen tubes and simple form of apparatus described in this paper, of Mr. Matthews, Portugal Street, Lincoln's Inn.

the form of distinct propositions, the results which I have obtained :—

1. That for the production and identification of crystals of arsenious acid and crusts of arsenic, and for all analogous purposes, the short tube and microscopic glass* are greatly to be preferred to the reduction-tube at present in use.

2. That this method is free from many objections which attach to the one in common use; while it is more easy of application and much better adapted to the detection of minute quantities of the metal or its oxide.

3. That by this means so small a quantity as the thousandth of a grain of metallic arsenic may be readily converted into arsenious acid, and easily and completely identified.

4. That sublimed metallic arsenic is deposited on cooled surfaces, in the form of globules, as constantly as arsenious acid in the form of octahedral crystals; that the globules are easily recognised in pure unmixed crusts of the metal obtained by reduction, and even in crusts procured by Marsh's method; and that they may be seen also in mixed crusts of the metal and its oxide.

5. That the different appearances assumed by the pure unmixed crust of metallic arsenic are due chiefly to the quantity of metal which they contain, while those of the mixed crust, as shown in figures 38, 39, and 41, result from the different proportions in which the two elements—the globules of the metal and the octahedral crystals of the oxide—are blended.

6. That the globules of metallic arsenic show a tendency to arrange themselves in regular forms, especially in the form of circular, or nearly circular, spots of small globules, bordered by larger ones, and separated from each other by equal, or nearly equal intervals.

7. That it is possible by the plan described at page 261 to transfer the crust obtained by Marsh's method from an opaque to a transparent medium,—from porcelain to glass,—so as to obtain, if it were needed, an additional means of discriminating the crusts of arsenic and antimony.

8. That the tests of chloride of lime and sulphide of ammonium are applicable to the thicker crusts of metallic arsenic no less than to the thin crusts obtained by the use of Marsh's apparatus.

* When it is not intended to identify the crusts of arsenic by procuring crystals of arsenious acid, common window glass may be used instead of microscopic glass, and is even to be preferred.

SPHYGMOSCOPES FOR INDICATING THE MOVEMENTS OF THE HEART AND BLOOD VESSELS.

By S. Scott Alison, M.D.,
Assistant Physician to the Hospital for Consumption.

THE engraving shows the different forms of these instruments which I have employed. An account of the mode of using them will be found in No. 18, vol. viii., of the "Proceedings of the Royal Society," January 10th, 1856.*

Fig. 45.

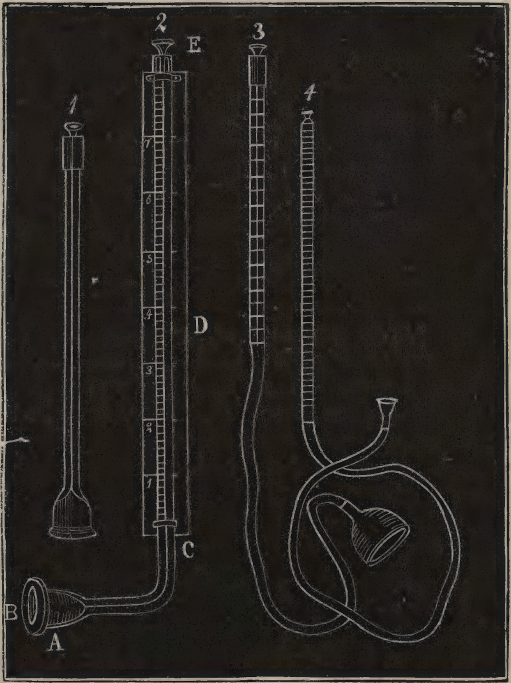


Fig 1. Artery sphygmoscope. Bore of tube 1-16th of an inch.

Fig 2. Portable heart sphygmoscope. A, Glass cup, containing coloured water. B, Lamina of India-rubber, covering the mouth of the cup. C, Glass tube; bore 1-10th of an inch. D, Graduated scale. E, Screw stopper.

Fig. 3. Heart sphygmoscope supplied with India-rubber tube, to admit of greater facility of comparison with movement of artery sphygmoscope, and greater readiness of observation when listening to the sounds of the heart.

Fig. 4. Artery sphygmoscope, with India-rubber tube.

* See also "The Lancet," November 8th, 1856.

ON THE PREPARATION OF DIGESTIVE POWDER FROM THE PIG'S STOMACH.

By the Editor.

VARIOUS chemical processes more or less complicated have been employed in the preparation of pepsin. Partly, in consequence of these being tedious and difficult of performance, and the results uncertain, and partly from the sale of perfectly useless preparations, the remedy has of late to some extent lost its reputation. Having been engaged in some experiments upon artificial digestion, and having met with considerable difficulty in obtaining clear solutions of digestive fluid that would filter, I tried various new plans of preparing digestive solutions. The following answers very satisfactorily, is very simple, and free from many of the objections to which other processes are liable.

The mucous membrane of a *perfectly fresh* pig's stomach is carefully dissected from the muscular coat, and placed on a flat board. It is then cleansed with a sponge and a little water, and much of the mucus, remains of food, &c., carefully removed. With the back of a knife, or with an ivory paper-knife, the surface is scraped very hard, in order to press the glands and squeeze out their contents. The viscid mucus thus obtained contains the pure gastric juice, with much epithelium from the glands and surface of the mucous membrane. It is spread out upon a piece of glass, so as to form a very thin layer, which is dried at a temperature of 100° over hot water, or in vacuo over sulphuric acid. When dry it is scraped from the glass, powdered, and kept in a stoppered bottle. A good digestive fluid may be made as follows :—

Of the powder	5 grains.
Strong hydrochloric acid	18 drops.
Water	6 ounces.[1]

The fluid may be filtered easily, and forms a perfectly clear solution, very convenient for experiment. If it is to be taken as a medicine the powder may be mixed with an equal quantity of starch, and 10 grains of the mixture taken for a dose, a little diluted hydrochloric acid in water being taken at the same time. It may be taken with the salt at a meal. The powder is devoid of smell, and has only a slightly salt taste. This powder undergoes no change if kept perfectly dry. It contains the active principle of the gastric juice almost unaltered.

REPORTS OF RESEARCHES PUBLISHED ELSEWHERE.

SUCCI GASTRICI HUMANI INDOLES PHYSICA ET CHEMICA, OPE FISTULÆ STOMACHALIS INDAGATA; AUCTORE OTTO A GRÜNEWALDT. DORPAT. 1853.

The Physical and Chemical Properties of the Human Gastric Juice, investigated by means of a Fistula into the Stomach; by Otto A. Grünewaldt. Dorpat. 1853.

(ABSTRACT BY DR. MURCHISON).

THE above is the title of a Graduation Thesis, presented to the University of Dorpat, in 1853, by Otto A. Grünewaldt. The chemical analyses were made by Professor Schmidt, and their accuracy may, therefore, be relied on.

Chap. I. Description of the Fistula.—The subject of the fistula was a peasant woman, Catherine Kütt, a native of Esthonia; and the opening in the abdominal parietes was established two and a half years before she came under observation. From the symptoms it appeared probable that the fistula was the result of a simple ulcer of the stomach, which perforated first the coats of this viscus, and secondly, the adherent abdominal walls. The woman, when she came to Dorpat to be made the subject of observation, was thirty-five years of age, robust, and in the enjoyment of good health. She was also suckling a strong and healthy female infant, which she had given birth to about a year before.

The opening was situated at the bottom of a deep fold of the integuments in the left side, below the left mammary gland, and between the cartilages of the ninth and ten ribs, two and a half inches in a horizontal line from the lower extremity of the xyphoid process of the sternum. It resembled a fissure three or four lines long, the edges of which were in contact, but allowed the fluid contents of the stomach to escape. The margins were red, hard and callous, and the surrounding skin, over a space measuring three or four inches in diameter, was irritable and red, from the constant distillation of the gastric fluid.

A probe could be introduced two or three inches into the fistula, without encountering any obstacle or exciting any pain, When an attempt was made to push it in farther it came in contact with an elastic substance, and produced an unpleasant sensation. A greater or less quantity of fluid was almost con-

stantly distilling from the aperture, the nature and character of which evidently varied with those of the food which had been swallowed. Thus if the patient swallowed milk, this fluid immediately escaped by the aperture.

The patient was anxious to have the aperture closed up, but objected to any cutting operation. It was accordingly resolved by means of a gutta percha compress and a belt, not only to bring into contact the margins of the aperture, but also to double in and approximate portions of the surrounding sound skin, which were then to be cauterized, with the object of inducing granulations and adhesions. This procedure, however, was deferred for a time, and its result is not given in the Thesis.

Chap. II. On the Mode of Obtaining the Gastric Juice.—The fluid was obtained by introducing into the opening an elastic tube, about the thickness of a small goose-quill, a small piece of whalebone being employed to clear the tube when it became obstructed by particles of the food.

The author then proceeds to give, in a tabular form, the results of sixty-two observations made upon the fluid thus obtained, which he classifies under the following heads :—

1. The day and hour of the observation.
2. The nature of food last swallowed before the experiment.
3. The time which had elapsed since the last meal.
4. The number of minutes necessary for obtaining the quantity of fluid mentioned under the next column.
5. The quantity of fluid, before filtration, which escaped in the time mentioned in column 4.
6. The same, after filtration.
7. The quantity of fluid calculated to escape in one hour.
8. The same quantity, after deducting the probable amount of saliva, which had been swallowed within the hour. In order to arrive at some information upon this point, the author made a number of experiments of this nature upon different individuals. He made each chew a piece of gum elastic, and spit out all the saliva which collected in the mouth during one hour. He then calculated the proportion which this quantity bore to the total weight of the individual's body, and came to the conclusion, that Catherine Kütt, whose weight was 53 kilogrammes (8 stone 5 lbs.), would secrete 65 grammes ($2\frac{1}{3}$ drams avoird.) of saliva in one hour.
9. The reaction of the fluid.
10. The presence of sugar as ascertained by Trommer's test.
11. The quantity of soda necessary to neutralize one thousand parts of the gastric fluid.

12. The physical characters of the fluid.

13. Microscopical and other observations.

Chap. III. The quantity of the Gastric Juice.—The author admits that his observations under this head are open to certain fallacies. Thus he allows, that it is difficult to say whether a portion of the fluid collected may not have been derived from the ingesta. It is, however, an acknowledged fact, that the fluid portion of the ingesta is absorbed in less time than that which intervened between deglutition and his experiments, while the solids which came away by the canula were separated by filtration. The author also concedes, that the quantity of gastric juice may have exceeded the normal proportion, owing to the enormous appetite of the woman, who consumed daily 4 lbs. of rye bread, in addition to a liberal allowance of other articles of diet. He does not, however, attach much weight to this circumstance, inasmuch as the woman was suckling, and as there was a constant drain from the system through the fistula. On the other hand, he calls attention to the fact, that the fistula was situated at the part of the stomach most remote from the pylorus, and that, consequently, it was probable that the greater part of the fluid secreted to the right of the fistula passed directly into the small intestine, in place of escaping by the external opening. The estimated quantity was farther reduced by occasional obstructions to the flow through the tube, by some of the fluid escaping by the sides of the tube, and moistening the patient's linen, and by the probability that a certain portion always remained behind in the stomach. On the whole, he concludes that his calculation is considerably under, rather than above, the truth.

Taking into consideration these various circumstances, the quantity of gastric juice secreted by the stomach does not appear extraordinarily great. Thus, according to the author's mode of computation, 584 grammes (1 lb. 4 oz. 10 dr. avoird.) was the average (of sixty-two observations) amount of gastric juice secreted in the space of one hour, a quantity equivalent to 14·016 kilogrammes (30·27 lbs. avoird.) in twenty-four hours. The author considers that there is no exaggeration in his conclusion, that in the case of a healthy adult man, the stomach secretes in twenty-four hours 264 grammes ($9\frac{1}{2}$ ounces avoird.) for every kilogramme (2·2046 lbs. avoird.), which his body weighs.

The quantity of fluid varied considerably at different times; and this greater or less activity of the secreting process would continue for several days at a time. The swallowing of fluids increased this activity; and various observations are alluded to to prove that this increase was not merely apparent, owing to

the escape of the fluids swallowed, directly by the canula. Allusion is made to the constant interchange which takes place between the fluid contents of the stomach and the blood. The quantity of gastric juice was always least when the stomach was empty, as during the night and in the morning.

Chap. IV. Physical Characters of the Gastric Juice.—It is described as being generally a limpid, watery fluid, with a slightly reddish colour, which, however, varied in hue, and appeared to depend upon the nature of the food. Occasionally it exhibited a considerable amount of viscidity, and especially on those days on which the patient had been in low spirits or had been crying. This increased viscidity is attributed partly to the swallowing of an increased quantity of saliva and nasal mucus, and partly to a catarrhal condition of the mucous membrane of the stomach itself. On several occasions, even when the patient was in perfect health, the fluid drawn in the morning from the empty stomach contained bile. Microscopic examination of the fluid showed it to contain particles of the food more or less changed by the digestive process; and on three different occasions, sarcinæ were detected. On all these occasions the patient was fasting; on two of them the fluid was alkaline; and on the third, neutral.

Chap. V. Chemical Analysis of the Gastric Juice.—Under this head are given, in considerable detail, the results of three analyses of the gastric juice made by Professor Schmidt.

From these experiments, the author draws the following conclusions:

1. The gastric juice of man contains a certain albuminous principle (Pepsine), which coagulates at a temperature of 100° Cent.

2. It also contains butyric acid, and very probably lactic acid, which are to be regarded as the intermediate products of the metamorphoses, to which the articles of food containing hydrocarbons are subjected, at a temperature of 35° to 37° per cent.

3. The human gastric juice contains no free hydrochloric acid, although Messrs. Bidder and Schmidt have obtained undoubted evidence of the existence of this acid in the gastric juice of the lower animals.

The author doubts if hydrochloric acid is really absent from the genuine gastric juice of man; and considers that it exists in such small quantity as to be neutralised by the alkaline saliva which has been swallowed. The invariably alkaline character of the fluid obtained from the empty stomach is attributed to the saliva. His experiments tend to show that the organic acids are solely derived from the ingesta.

The following Table give Bidder and Schmidt's analyses of the human gastric juice, as compared with that of some of the lower animals :—*

	Dog without saliva.	Dog with saliva.	Sheep with saliva.	Man with saliva.
Water	973·062	971·171	986·147	956·595
Solid Residue	26·938	28·829	13·853	43·405
Ferment or Pepsine	17·127	17·336	4·055	36·603
Inorganic Matters, consisting of	9·811	11·493	9·798	6·802
Hydrochloric Acid	3·050	2·337	1·234	..
Chloride of Potassium	1·125	1·073	1·518	..
Chloride of Sodium	2·507	3·147	4·369	4·633
Chloride of Calcium	0·624	1·661	0·114	..
Chloride of Ammonium	0·468	0·537	0·468	..
Phosphate of Lime	1·729	2·294	1·182	0·961
Phosphate of Magnesia	0·226	0·323	0·577	0·260
Phosphate of Iron	0·082	0·121	0·331	0·006
Potass united with organic matters	..	..	..	0·363

Remarks.—The above case deserves to be better known in this country than it generally is, as it is one of the few instances of gastro-cutaneous fistulæ which have been made the subject of careful observation. The case, however, is by no means such an unique one as the author of the dissertation before us seems to think. In a paper published in the Medico-Chirugical Transactions for the present year, I have recorded a very remarkable case of an opening into the stomach through the abdominal parietes, which was produced by external pressure. The fistula has existed for $4\frac{1}{2}$ years, and the patient is still alive. In the same paper, I have collected twenty-four other cases of a similar lesion resulting from different causes.

The fact of no free hydrochloric acid having been found by Professor Schmidt in the gastric juice of Catherine Kütt is rather at variance with the results arrived at many years ago by Dr. Dunglisan, who obtained hydrochloric acid with great readiness from the gatric juice of Alexis St. Martin. It is interesting to observe, however, that Alexis St. Martin, whose fistula has existed now upwards of thirty-five years has recently been made the subject of a fresh series of experiments by Dr. F. S. Smith† of Philadelphia, who has failed to detect any free hydrochloric acid in the gastric juice, the acidity of which he considers due to lactic acid.

* The copy of this Table, given by Dr. Carpenter, in the 5th edition of his "Principles of Human Physiology," (p. 81) is quite incorrect.

† Philadelphia Med. Examr., July and Sept., 1856, and Brit. and For. Med. Chir. Rev., Janry., 1857.

JOURNALS WITH WHICH THE "ARCHIVES OF MEDICINE" IS EXCHANGED.

Glasgow Medical Journal.

Journal de la Physiologie de l'Homme et des Animaux, publié sous la direction du Docteur E. Brown-Sèquard.

American Medical Monthly.

Quarterly Journal of Dental Science.

Ophthalmic Hospital Reports and Journal of the Royal London Ophthalmic Hospital.

Archiv für Pathologische Anatomie und Physiologie, und für Klinische Medecin.

North American Medico-Chirurgical Review.

Archiv für die Holländischen Beiträge zur Natur and Heilkunde.

*** The Editor will be happy to exchange with other Journals.

BOOKS RECEIVED.

J. Da Costa, M.D., Philadelphia., An Inquiry into the Pathological Anatomy of Acute Pneumonia.

J. Da Costa, M.D., Philadelphia, On the Morbid Anatomy and Symptoms of Cancer of the Pancreas.

Lucien Corvisart, Sur une fonction peu connue du Pancréas, la digestion des aliments azotés.

W. M. Gunning, Untersuchungen über Blutbewegung und Stasis.

Th. Mac-Gillavry, Onderzoekingen over de Hoegrootheid der Accommodatie.

Dr. Bond, On the Pathology of Rheumatism.

H. F. Baxter, M.R.C.S.L., On Organic Polarity. From the Trans. of the Cambridge Phil. Soc., 1858.

Lockhart Clarke, F.R.S., Researches on the Intimate Structure of the Brain, Human and Comparative. First Series, On the Structure of the Medulla Oblongata.

Prof. Kölliker, Ueber die Leuchtorgane von Lampyris.

Dr. Harley, The Histology of the Supra-renal Capsules.

Review on Kiernan, Beale, and Jones., On the Minute Anatomy of the Liver. From the Midland Quarterly Journal of the Medical Sciences.

Mr. S. D. Bird, On Scurvy as it appeared in the Allied Armies, &c.

Mr. John Roberton, A few Additional Suggestions with a view to the Improvement of Hospitals.

Dr. Guy, The Mortality of the British Army.

Mr. J. Lister, On Spontaneous Gangrene from Arteries, &c.

Dr. William Odling, Reports on the Effects of Sewage Contamination upon the River Thames.

H. W. Acland, M.D., F.R.S., Note on Teaching Physiology in the Higher Schools.

H. W. Acland, M.D., F.R.S., Report on Cases of Fever occurring in the parish of Great Horwood, in the county of Buckingham.

Graily Hewitt, M.D., On Vesicular Emphysema of the Lungs in Early Childhood.

J. A. Easton, M.D., On the Elimination, Catalysis, and Counteraction of Poisons, with especial reference to Syphilis and Lead.

A. W. Pinkerton, M.D., The Spread of Cholera by Personal Communication, as seen in the Crimean Campaign.

J. C. Clendon, On some Severe Forms of Disease arising from the Retention of decayed Teeth.

Charles Murchison, M.D., Remarks on the Changes which are supposed to have taken place in the type of continued Fever.

Charles Murchison, M.D., Remarks on the Classification and Nomenclature of continued Fevers.

Dr. Medlock, The Record of Pharmacy and Therapeutics.

John Hughes Bennett, M.D., F.R.S.E., The Classification, Pathology, and general Treatment of Morbid Growths, From the Midland Quarterly Journal of Medical Science.

Professor C. Eckhard, Beiträge zur Anatomie und Physiologie.

George Rainey, On the Mode of Formation of the Shells of Animals, of Bone, and of several other Structures.

Joseph Lister, F.R.C.S., On the Early Stages of Inflammation (Abstract).

TO THE BINDER.

The 'Table of Contents, lists of illustrations, and analyses' to follow the preface.

The plates of all four numbers at the end of the volume, preceded by the 'Explanation of the plates,' and followed by the 'Index.'

CLINICAL OBSERVATIONS.

CASES ILLUSTRATING THE FORMATION OF SO-CALLED "FALSE MEMBRANES," IN CONNECTION WITH THE IMMEDIATE COVERINGS OF THE BRAIN; WITH OBSERVATIONS.

By John W. Ogle, M.D., Oxon,

Assistant Physician to St. George's Hospital. Honorary Secretary to the Pathological Society.

PLATE XXXI.

THE interest attaching to altered conditions and circumstances of any of the structures of the body is proportionate, for the most part, to the intrinsic importance of the functions which as vital organs they perform, or, their relations to adjacent parts which bear that character.

Thus is it, in an especial way, as respects the fibrous and serous tissues forming the membranes investing the brain and spinal chord, the diseases of which tissues occupy, deservedly, so large a share in the minds of all clinical and pathological observers.

In addition to the weighty consideration which diseased states of these structures claim during life, by the symptoms which they establish and which constitute the basis for diagnosis, prognosis, or treatment, perhaps there are no parts of the body more than these, of which the changes as observed after death merit more regard than they do. For in addition to other grounds, it is in a medico-legal aspect especially, that such deviations may form the groundwork for most important conclusions depending upon the supposed origin and behaviour of certain products of unusual occurrence, and most conspicuously as regards what are termed "false membranes" or cysts, between the dura mater and the arachnoïd, or between the

latter tissue and the pia mater, or it may be within the cranial ventricles themselves. The source of such false membranes or cysts has been recognised for some time as being referable to two totally distinct processes; and discussions have at times been raised whether the products in any given instance were due on the one hand to the coagulation of blood directly extravasated from blood-vessels in some way or other ruptured, or on the other hand to the aggregation of inflammatory exudations. This discrimination between two methods of origin has been treated of in the well-known paper by my friend and colleague Mr. Prescott Hewett* on "Extravasation of Blood into the Cavity of the Arachnoïd," and Mr. Hewett has very fully and prominently, in that place, brought to notice the various ways in which membranes or cysts containing blood, whether altered or unchanged, may be formed about the cerebral membranes. He also expresses an opinion that in the majority of cases these products are the results of lesions from outward injury, all traces of which have been long since worn away.

Now, in attempting at all adequately to institute a minute examination into the origin and constitution of such of these structures as are obviously of ancient standing and whose nature is consequently obscure, the following appear to form the most salient points of enquiry:—

FIRSTLY. Is the given subject of investigation (membrane or cyst) merely old standing fibrine which has been deposited under some simple inflammatory process along with the albuminous serum of the blood which has been re-absorbed (or in the case of a supposed cyst, more or less surrounded and hemmed in by coagulated fibrine)?

Or again, is it formed of such above-mentioned fibrine of inflammatory origin having mixed with it, in addition, actual blood globules thrown out as part of the inflammatory process?

SECONDLY. Is the membrane or cyst in question simply and solely altered blood which has become extravasated? And if so, did the hæmorrhage arise from lesion occasioned by outward injury, or from rupture by inward pressure alone, of the blood vessels; and if it took place from inward pressure only, was this furthered by or wholly independent of organic alteration in the parietes of the blood-vessels?

Or THIRDLY, is it, as it were, the result of a union of the two processes; that is, has there been blood extravasated in the

* See page 45, in volume 28 of the "Transactions of the Royal Medical and Chirurgical Society of London." See also a Report by Mr. Hewett, on a large cyst formed from extravasated bood, in the "Transactions of the Pathological Society," vol. 6, page 10.

first instance, whether as arising from mechanical injury, or from some other cause upon which inflammatory processes have, perhaps consequent to irritation thereby produced, supervened?

Or, in the Fourth place, was the hæmorrhage, if such existed, one of a spontaneous character, and owing to some modification in the constitution of the blood itself, favouring the escape of the globules from the vessels, such as we are well acquainted with as occurring under certain general conditions of the system?

All the foregoing points of investigation have great interest attached to them; but they appear to me to be, owing to a somewhat deficient amount of material on which to build up any conclusions, only as yet to a certain degree capable of final solution

In such matters experimental research, such as I hope to suggest and further at another time, would materially aid, as also an increase in number of clinical cases and observations with carefully ascertained histories, if they can be had.

As far as my own experience goes, the discovery of these false membranes in connection with the cerebral coverings, and especially as found coating the inner surface of the dura mater, are by no means so rarely to be met with as might be supposed; and I hope to be able to show that they may, not by any means infrequently, be found under local circumstances and general conditions quite different to any which I have already mentioned as being looked upon as their source, that is under circumstances, &c., pre-supposing or requiring neither hæmorrhage of any kind whatever, nor the establishment of active processes of inflammation, whether secondary or not to previous extravasation of blood. Upon these further causes of the false membranes, &c., I will remark at a later period.

I will now proceed to give in more or less detail, certain cases illustrative of the formation of such false membranes, omitting such inferences as may be suggested by them until the narration of the cases be completed.

Case 1, *with Plate.—Epileptic seizures following injury to the Head.—Death from the bursting of a Gastric Ulcer.—Delicate "False Membrane" found after Death lining the inner surface of the Dura Mater covering both Cerebral Hemispheres, and Small Tumour connected with the same surface.—Old fracture of the Cranium.*

The patient was a man, J. S., aged 46, who died in St. George's Hospital, 1856.

Previous History.—He had, some three years previously, been kicked by a horse, and suffered fracture of certain ribs, which was followed by dyspnœa and hæmoptysis. From this accident he was recovering when he fell from his horse on to the back of the head, causing a scalp wound. After this he was delirious for a time but appeared to have recovered so as to go on with his ordinary employment. He was suddenly attacked one day with two convulsive attacks, after which he vomited much dark blood. During the attacks he lost consciousness, but not entirely.

Symptoms on admission.—Face very ancemic, and pulse scarcely perceptible, no doubt from loss of blood; tongue coated thickly, and of a brownish yellow colour. During the next few days he vomited much, but no blood; and he was subsequently attacked with severe epigastric pain, giddiness, and dimness of sight. After vomiting quantities of dark brown material he gradually sank and died.

On Post-mortem Examination—*Thorax*.—Nothing of moment was found within this cavity.

Abdomen.—A small simple ulcer in the upper part of the anterior surface of the stomach was found, as well as a very large one in the posterior wall blocked up by an adherent pancreas. Through the ulcer in the anterior wall the contents of the stomach had found their way into the general peritoneal cavity.

Cranial cavity.—The soft parts covering the cranium presented nothing unusual. An extensive fracture of the cranial bones on the left side was found, a large part of which was united, but the lower half was still ununited, the interval being filled up by fibrous tissue. The exact condition of the bone thus ununited, &c., has been fully and minutely described by my friend Mr. Gray, who brought it before the notice of the Pathological Society,* along with the remarkable condition of the left lateral sinus and jugular vein, &c.

But in addition to the fracture of the bone, I found the following peculiarities, which were not recorded in the Pathological Transactions. The dura mater generally appeared to be healthy, but was far more than usually adherent to the skull; and lining its inner surface on both sides of the brain a fine and delicate fibrous structure was found: connected also with the inner surface of the dura mater at the middle of the left side and at a point about two inches from the falx cerebri was a small white tumour raised at its greatest height about ¼ of an inch from the surface, and gradually sloping down to the level of the dura mater. Corresponding to the tumour was a depression of the surface of the cerebral hemispheres which at this point was otherwise healthy and not over vascular: and around the tumour, the dura mater and the corresponding arachnoïd membrane were intimately adherent. Moreover very firm and plentiful and reticulated adhesions were found to exist between the arachnoïd and the dura mater corresponding to the extremities of the anterior and middle cerebral lobes on both sides. These adhesions also contained a quantity of reddish or brick-coloured material. Two or three of the convolutions of the anterior and middle lobes, just mentioned, were indurated and corrugated, but the immediately surrounding tissue to a slight extent, and especially the white matter, was very softened. In other respects the brain tissue was natural, and the ventricles, except a few well-marked cysts of the choroïd plexus, presented nothing worthy of observation.

Microscopical Examination.—On examining the brain itself, the hard and corrugated parts, where were the coloured adhesions, were seen to contain a large number of fat-covered capillaries, along with much granular matter and free fat globules, and also vast numbers of round and oval-shaped granulated darkish masses. The surrounding softened parts of the brain contained numbers of nerve-cells obviously undergoing fatty changes; and fatty and granular matter were met with in abundance. The minute capillaries did not present anything worthy of comment.

* See the "Transactions of the Society," vol. 7, page 282.

The yellow-coloured reticulated adhesions presented, amidst delicate fibrillated tissue, much granular and fatty matter, and also numbers of oval and round brownish-red small masses with variously sized irregular bodies of a calcareous nature, many of them possessing a concentric arrangement.

The fibrous false membrane before mentioned as lining the dura mater, was seen to consist of a granular looking stroma (see PLATE XXXI, fig. 1) containing very delicate and fine fibres coursing chiefly in a parallel direction, and having mixed with it here and there largish aggregations of a yellow and yellowish-brown coloured granular material (see Fig 2), some being disposed in an oval and rounded form, unaffected by the addition of acetic acid or sulphuric ether. Moreover, in various places, were evident remains of blood globules, and also small faintly outlined round and oval corpuscular elements of about twice their dimensions, some of them passing into fibres. Mixed with the above there was a good deal of calcareous matter in places, many of the calcareous bodies having a concentric character.

Besides these elements numbers of capillary blood-vessels were seen containing in the substance of their walls nuclei of an oval shape, and occasionally beset with reddish-brown calcareous particles and glomerules of various sizes. Almost all these capillary vessels sent off branches at nearly right angles, which thus formed an infinite number of somewhat irregularly-shaped quadrilateral meshes, as seen in the Plate, fig. 1.

The small white tumour, spoken of in connection with the inner surface of the dura mater, was found to consist of a thick and firm outer portion, having all the microscopical characters of fibrous tissue, and an inner or contained part of a yellowish white colour and very softened. The whole had the appearance of having been originally a mass of fibrin, of which the central portions had softened, broken down, and undergone fatty and calcareous transformation.

Case 2.—*Epilepsy.—Hæmoptysis.—Petechiæ.—" False Membrane" lining the Dura mater.—Extravasated Blood in the Arachnoïd Cavity.*

The patient was a man, J. H., aged 41, who died in St. George's Hospital, in the year 1849.

History.—He had been for some time attending the hospital as an out patient, owing to cough and hæmoptysis. On the day of his admission into the hospital he had an epileptic attack, after which he had lost his consciousness. He rallied for a time from his insensibility, but again relapsed and was brought in unconscious but without decided coma or paralysis. Subsequently coma came on and stertorous breathing. It was noticed that he had many petechial spots on various parts of the person. He died very shortly.

ON POST-MORTEM EXAMINATION.—The cranial bones with their coverings were found to be natural. The brain and the dura mater were healthy, but lining the inner surface of the latter membrane as it covered the upper part of both cerebral hemispheres, though extending much further on the left side than on the right, was a layer of false membrane of a rusty or pale brick colour, and of about the thickness of a piece of cartridge paper,—this structure was rather firmly adherent to the dura mater, and at one part, corresponding to the upper and front portion of the anterior cerebral lobe, it was closely adherent to the arachnoïd membrane itself.* A quantity of dark coloured extravasated blood was also found accompanying this false membrane between the dura mater and the arachnoïd covering

* This specimen may be seen in St. George's Hospital Museum, as No. 1. a. Sub-series 6, Series xxi.

both cerebral hemispheres, and within the meshes of the pia mater, covering the outer part of the right hemisphere of the brain. A small quantity of semi-purulent fluid was also found in the sub-arachnoïdœan spaces at the base of the brain.

The other organs of the body presented nothing particularly worthy of remark.

Microscopical examination showed a decidedly fibrous character of the false membrane; the fibres having in places some resemblance to wavy fibres as found in many textures of the body, and having in places mixed with them, the débris of blood globules which had undergone change. No blood-vessels could be detected in the structure.

Case 3.—*Thin False Membrane Lining the Inner Surface of the Dura Mater, associated with Thickening and Opacity of the Arachnoïd Membrane.* — "SCROFULOUS" *Deposit in the Lungs.*—"CARCINOMATOUS" *Deposit in the Pleura, Liver, Lymphatic Glands, and Supra-renal Capsules.*

The patient was a French woman, A. D., aged 38, who died in St. George's Hospital in 1856.

Symptoms on Admission.—When admitted she was complaining greatly of pain in the course of the left ureter which she said she had been subject to for nine months. She was pale and emaciated, but free from any peculiarly cachectic look, and she was troubled with cough and frequent expectoration. Her nights were very disturbed, but there was apparently no interference with any of the mental faculties, and no headache was complained of. For some time she improved considerably, her only complaint being of that excessive debility, and occasional tympanitis along with the above mentioned want of sleep. Diarrhœa came on and she quickly sank.

Treatment consisted of sedatives, such as henbane and morphia, for the want of sleep, and general tonics and stimulants with cod liver oil.

POST-MORTEM EXAMINATION.—*Thoracic Cavity.*—The pleura in several places presented nodules of undoubted medullary "*carcinomatous*" matter, and on both sides of the chest the apices of the lungs were found to contain miliary deposits of "*scrofulous*" matter; otherwise, the lungs were healthy. The heart was small in size and flabby, but otherwise natural.

Abdominal Cavity.—The liver was found to be very large, and to be in several places occupied with circular masses of soft medullary carcinomatous material. Similar malignant deposits were met with in the lymphatic glands of the mesentery, omentum, and lumbar region. The kidneys also were much occupied by this malignant material, especially the left one, the proper substance of which was almost entirely destroyed. Both supra-renal capsules were entirely infiltrated with the same kind of deposit.*

Cranial Cavity.—The cranial bones and their coverings were healthy. The brain and cerebellum were also healthy in all respects, but lining the dura mater covering the upper parts of both lateral cerebral hemispheres (which was itself apparently external) a layer of recent soft fibrine was found, and this was the case to a greater extent on the right side of the cranium. This layer of fibrine was tolerably adherent to the inner surface of the dura mater, and could without much trouble be peeled off as a distinct diaphanous membrane of pretty firm consistency. The arachnoïd membrane generally was opaque and somewhat thickened, and much clear serous fluid was situated immediately subjacent.

* In connection with this altered condition of the supra-renal capsules the freedom from any discoloration of the skin must not pass unnoticed.

Microscopical Characters. — Passing over the microscopical appearances of the deposit found in various organs of the body,* I will only dwell on those of the "false" or fibrinous membrane found lining the inner surface of the dura mater. This presented the well known appearances of fibrillation which exuded fibrine, or as it is yet sometimes termed, "lymph," undergoes. Some amount of evidently fatty granular and amorphous albuminous matter existed also, but no distinct cell structure was met with; and in no portions examined could I discover traces of any vascular formation or débris of blood-globules, hæmatine, &c.

Case 4.—This was one of which the only history attainable is that the patient suffered during life from "compression of the brain." The specimen consists of a portion of the dura mater covering both cerebral hemispheres, having attached to its inner surface, though more extensively on the right side than on the left, a layer of reddish-yellow or brick-coloured "false membrane." This substance is also much thicker on the right side than on the left.

The preparation was removed from the body of a man very many years ago, and was presented to the St. George's Hospital Museum by Sir B. C. Brodie.†

Microscopical examination, after maceration for many years in spirit, showed a granular and delicately fibrillated material containing, here and there, small rounded and nucleus-like pale corpuscles and accumulations of round and oval brownish red, and in places garnet-coloured material, the whole greatly cleared by acetic acid. No blood-vessels were any where met with.

It appears to me that in this case, although the history fails, yet the known fact that the patient was said to have had "compression of the brain" during life, renders it very highly probable that he had suffered from some accident, as at that period especially, the expression "compression" would only be made use of in connection with what may be termed, for the sake of distinction, some surgical cause.

Case 5.—*Epileptic Attacks and Headache following a Blow on the Head.—"False Membranes" found adherent to the Inner Surface of the Dura Mater.*

History.—The patient was an intemperate man, aged 37, who nine months before death received a blow upon the head, and who had been subsequently liable to epistaxis, giddiness, indistinct vision, headache, and epileptic seizures. He died of coma in connection with disease of the kidney.

I have already given the details of the case at page 5 of the sixth volume of the "Transactions of the Pathological Society," along with some observations, and therefore I say but little concerning it in this place. I cite it here without giving the particulars of the case, as I am anxious to include it amongst those kindred cases which I am now adducing. Suffice it to say, that, on *post-mortem examination* a very delicate, but at the same time firm, "false membrane" was found lining, and rather firmly adherent to, the under surface of the dura mater. It was quite smooth and glossy, and excepting one or two places, where slight remains of blood extravasation existed causing small patches of a reddish hue, was uniformly of a white colour. It could be split up into two or three laminæ.‡

Microscopical examination showed the membrane to consist of numbers of delicate fibres interwoven and mixed with a homogeneous substance, in which many nuclear bodies were seen. No blood-vessels were found in its substance, and no epithelium covering its free surface.

* The simultaneous occurrence of scrofulous and carcinomatous deposit not only in the same body, but even in the same cavity of the body, should not pass unobserved.

† It is now catalogued as No 3, a., Subseries 6, Series xxi.

‡ I have added this specimen to the St. George's Hospital Museum as No. 4, a, Subseries 6, Series xxi.

The arachnoïd covering the cerebral convolutions was quite natural and transparent.

In this case it seemed that one or two of the small arteries coursing along the surface of the brain which were very highly atheromatous, rigid, brittle, and prominent, had been snapped by the external injury to the head, and that in this way hæmorrhage had taken place into the cavity between the dura mater and arachnoïd immediately covering the cerebral hemispheres.

Case 6.—*Thin Layer of Fibrinous Material forming a "False Membrane" lining the Inner Surface of the Dura Mater.—Peculiar Pedunculated Growths connected with the Arachnoïd Carcinomatous Disease of various Organs.*

This case has, like the last one, been related by me in the "Transactions of the Pathological Society" on account of the peculiar villous growth of the anachnoïd.* In the details of the case thus seen, I only mentioned the fact without dwelling upon it, that a thin false membrane was found lining the dura mater covering both cerebral hemispheres. In this case the anachnoïd, in addition to the growth from it, was found opaque and thickened to a certain degree.

This condition of things was found after death quite fortuitously, the patient having died of malignant disease of the liver, kidneys, &c. The cranium, brain, &c., were healthy, as also the cerebral vessels; nothing was found noteworthy about the cranial contents excepting the above mentioned growth from, and altered condition of, the arachnoïd, along with the thin membrane coating the cerebral surface of the dura mater.

(*Cases to be continued in No. V.*)

CASES ILLUSTRATING THE USE OF THE OPHTHALMOSCOPE.

By Robert Taylor, F.R.C.S.,

Surgeon to the Central London Ophthalmic Hospital, and to the Cripples' Home,

AND

Edward C. Hulme, F.R.C.S.,

Assistant-Surgeon to the Central London Ophthalmic Hospital, and Surgeon to the Blenheim Free Dispensary.

PLATE XXVI.

IT is proposed in the following series to lay before the profession short notes of cases in attendance at the Central London Ophthalmic Hospital, comprising their histories, symptoms, the ophthalmoscopic examinations, accompanied by coloured drawings, and the results of treatment. The cases will not, at present, be arranged in any nosological classification, but merely recorded as they present themselves in the ordinary routine of hospital practice; at some future time, probably, an attempt may be made to group the symptoms and appearances together, so as to form some deductions as to

* See vol. 9, page 14.

treatment. The sketches in all cases will be taken from the patient by Mr. Taylor or Mr. Hulme, and chromo-lithography in the skilful hands of Mr. Tuffen West has in the present instance been selected as the means of publication. There is, and probably always will be, great difficulty in correctly representing the natural transparency of parts of such delicate structures as the inner tunics of the eye, but chromo-lithography affords a brilliancy of colour which is permanent, and a capability of multiplication which frequent printings do not impair.

Case 1.—William Mackay, æt. 28, a clerk, applied December 13, 1858. His health has been tolerably good from his childhood; he has passed through the ordinary complaints of that period, and in his youth has had several gonorrheas, but no venereal sores. His sight, as long as he can remember, has always been weak, and he has also suffered more or less from frequent headaches.

At the time of his application his sight had become so impaired that he was obliged to give up his work as a clerk; he complains of requiring more light than usual to be able to distinguish ordinary type. When he reads he is obliged to place the candle between his eye and the book. With his right eye he can read small print tolerably well at about eight inches distance, but the sight of the left is not nearly so good. He complains also of heat, aching, and general uneasiness in exercising his sight.

The eyes appear healthy to external examination; palpation normal; some internal venous congestion is shown by enlarged veins leaving the globe, and there are brown spots at their points of penetration of the sclerotic.

Ophthalmoscopic Examination.—*Left eye.*—Fig. 1, Plate XXVI.—The cornea, the lens and its capsule, and the vitreous humour are clear. The optic disc appears strongly shaded, especially towards the temporal side, throwing the centre into high relief. There is a general hyperemia of the disc, more towards the nasal side, and this side is also very faintly marked with very fine bluish striæ. The optic disc preserves its circular shape. The retinal vessels enter and leave normally, being rather more branched than usual. Two small arteries perforate the disc towards its outer edge, taking a direction towards the macula lutea. The retina preserves its transparency uninterrupted. The choroid is also normal, a pale bluish shade surrounding the optic disc.

The space around the macula lutea is healthy.

The treatment consisted of small doses of grey powder, with bark and soda three times a day, and blisters twice a week to the temples, with complete rest for the eyes.

Second Ophthalmoscopic Examination, February 13, 1859.—The appearances remain much the same, with the exception of the almost total disappearance of the faint blue lines on the optic disc.

Vision remains much the same.

This patient is still under treatment. He expresses himself as always being relieved by the use of the blisters, which he uses twice a week alternately to either temple.

Case 2.—William Brown, æt. 36, has been employed for many years as an engraver on metal, working chiefly at the ornamental engraving of gun locks. Nine months ago he discovered that the sight of the left eye was impaired, his attention being drawn to it by a dull, aching pain, and the appearance of flashes of light before it, after having worked for some hours. Since then the sight has got gradually worse, and now he can only discern the outlines of large objects passing before the eye, but can neither distinguish features, nor read the largest

print. He still complains of pain and coruscations after some hours' work. The right eye is asthenopic.

Ophthalmoscopic Examination.—*Left eye.*—Fig. 2, Plate XXVI.—The optic disc is of a dull grayish pink colour, slightly marked with faint striæ of a more decided pink. The colour gradually fades off towards the centre, which is of the normal white appearance. The circumference of the disc is surrounded to about two-thirds of its extent, by a jet black line of pigment deposit; for the remainder, towards the outer side, by a shade, as if the disc were slightly elevated above the surrounding parts. The vessels of the arteria centralis retinæ are much enlarged and distended, and their contents have not the usual bright tint of arterial blood. Several of the vessels in their course over the retina are bordered on each side by a fine, white line, probably of plastic exudation. The entire retinal surface that can be brought within the field of vision is of a much brighter red than in the healthy eye, and presents a velvety appearance which completely conceals all traces of the choroidal vessels, as well as of the macula lutea.

Case 3.—John Devine, æt. 39, blacksmith, applied February 1858. He is a man of healthy constitution. About 4½ months ago his left eye was injured by a blow from a piece of iron. The cornea has partially sloughed and has healed up by a fibrous cicatricial tissue; there is, however, sufficient clear cornea at the outer margin to make an artificial pupil as he has perception of light in that eye.

The right eye presents the appearance represented in the sketches Nos. 3 and 4. It was damaged 22 years ago by a blow while at the forge; the pupil is semi-dilated; the iris tremulous. By fully dilating the pupil with atropine, it appears, on examination with the ophthalmoscope, that the capsule of the lens remains suspended in its ordinary position, and is clear, sufficiently so, to examine the optic disc, and one or two vessels seen entering its centre. The lenticular matter is apparently absorbed, except the nucleus of the lens, which has sunk down and remains unabsorbed at the bottom of the capsule. On making the patient look up to the ceiling, and throwing the head well back, the appearance as shown in fig. 4 is seen—two fine lines being the remains of the suspensory ligament are seen to be the means by which the capsule is held in its position. Two small patches of uvea may be distinguished on the inner side of the capsule.

This patient has very fair sight with this eye; he can see large letters, and to get about in the street. He has been under observation about a year, with no sensible alteration in his state.

N.B.—The optic disc and its vessels, as seen through the transparent capsule, is hardly sufficiently represented by the lithographer.

Case 4.—Mary Smith, æt. 53, married, 14 children, a stout, plethoric-looking woman, her face covered with acne rosacea, applied for chronic ophthalmia of the left eye. About 16 to 20 years ago she discovered that the sight of the right eye was much affected, every thing appearing dim and ill defined. She has never suffered from any inflammatory attack in the right eye, although two or three times the left has been affected. She can read the ordinary type with her right eye, when brought quite close to her. Increase of light causes increased confusion.

The eye is healthy in appearance; in fact, she does not complain of it at all, but merely observes that this eye is always tired and feels uneasy first, when engaged about her work.

Ophthalmoscopic Examination. — *Right eye.*—December 10, 1858. — The cornea, the lens and its capsule, and the humours are quite clear. The optic disc presents the appearance represented in fig. 6, when the eye is everted. It has not the clear defined circular edge observed in the healthy optic disc. The surface of the disc is highly injected with numerous fine vessels, to such an extent on the outer side that the continuity of its circumference is quite lost. Numerous small vessels are seen directed towards the macula lutea, and large

tortuous branching vessels perforate the centre of the disc. Black pigment is seen deposited on the surface of the disc, as well as round its edge. The white, roundish, clear cut spots observable are due to the bright sclerotic shining through the choroid, which is atrophied and deficient in its pigment at those parts.

Fig. 5 represents parts over the macula lutea of the same eye as seen by making the patient look directly forwards. Here there is extensive choroidal deficiency, the edges of the atrophied choroid taking circular forms as though they were cut out with a circular punch. Pigment is deposited irregularly about the fundus. Enlarged choroidal vessels are seen taking their course in that membrane, and one large retinal vessel enters the eye at a purplish spot in the situation of the macula lutea and ramifies in the retina itself.

Treatment.—Iron, with small doses of sulphate of magnesia, have improved her health, and the acne has almost disappeared. Vision remains the same with the right eye.

[*To be continued.*]

CASES IN THE MEDICAL WARDS OF KING'S COLLEGE HOSPITAL.

REPORTED BY CHARLES PARSONS,

House Physician.

Case 1.—*Cancer of the Stomach.*

J. K., æt. 44, a teacher of music, married, was admitted under Dr. Budd, on February 3rd, 1859, with cancer of the stomach. She has had four children, the last of which was born eighteen years ago. Her health has always been delicate. Six years ago she vomited a wash-hand basin-full of blood, and a tea-cup-full twelve months ago. Complains of pain after eating, and for the past ten months has vomited after meals, and has lost flesh. In July last she had inflammation of the bowels (peritonitis?) and was laid up for four months. Six months ago she first noticed a small roundish swelling at the lower part of the belly on the right side, which gradually increased in size. About seven weeks ago the abdomen began to swell, and continued to enlarge up to the time of her admission.

Present condition.—Much emaciated; features sharp and pinched; expression anxious; eyes sunk; is too weak to stand; tongue red and glazed; has no appetite; vomits everything she takes, and suffers from diarrhœa. The catamenia were regular till last Christmas. At the lower part of the abdomen, on the right side, an irregular, ill-defined nodulated tumour can be felt, tender on pressure. Has great abdominal pain, cannot breathe in the recumbent posture, and sleeps little.

P. 76, R. 32.—Ordered logwood, krameria, and opium, to check the diarrhœa, and laudanum at night. To take also three minims of dilute hydrocyanic acid three times a day. Is much troubled with acid eructations. Complains of cough. *Rhonchus* audible over entire chest. *Expectoration* viscid, muco purulent. Distinct fluctuation in the abdomen.

February 16.—Is rapidly getting weaker, and more emaciated. Wanders a good deal. A creaking sensation was communicated to the finger on pressing in a slanting direction on the abdominal parietes. She gradually became weaker and more exhausted, and died on February 20, 1859.

Sectio-cadaveris, twenty-eight hours after death. Great emaciation; abdomen flaccid and fluctuating; several quarts of clear yellow serum, with a few shreds of lymph, escaped on opening the belly. The peritoneal covering of the intestines and abdominal walls was of a velvety consistence from the presence of a thin layer of partially organized lymph. The coils of small intestine were firmly matted together so as to produce the nodular projections, which were observed during life. Both the large and small intestines were filled with light yellow very offensive fœculent matter, and were bound down by the thickened mesentery, as well as by bands of adhesion to the abdominal parietes.

The liver, spleen, stomach, and transverse colon were closely connected, so much so, that it was difficult at first to ascertain the precise position of the stomach. On laying open this viscus it was found to be divided by a central cartilaginous constriction, about 1½ inches in thickness, forming a valve scarcely larger than the pyloric orifice, between the two halves of the stomach, which consequently assumed the hour-glass form. The stomach was very much contracted. The portion between the cardiac orifice and the constriction was scarcely large enough to hold a pear; and that towards the pyloric end, though longer, was of even smaller capacity. The gastric mucous membrane was thrown into deep corrugations, and exhibited, on microscopical examination, the usual appearances of stomach tubes, &c. The constricting ring consisted of a dense and closely set fibrous stroma, with granular matter, and a few small cells without nuclei. Liver enlarged but healthy; kidneys, uterus, ovaries, &c., quite normal in position, form, and texture.

Heart and lungs quite healthy, the former small and contracted, the latter crepitant and somewhat anemic.

Case 2.—*Hemiplegia.—Hemorrhage into Corpus Striatum and Optic Thalamus of Right Side extending into the Hemisphere.*

Martin Lambert, aged 53, a waiter, health usually good. He has lived intemperately; has never been subject to epilepsy or headaches.

On the afternoon of March 6, 1859, while standing behind "the bar," he suddenly felt a trembling in his limbs, fell down, and was unable to raise himself, but did not lose his consciousness; he was brought directly to the hospital, and admitted under the care of Dr. Todd.

On admission the left side of his face was found to hang somewhat, and was incapable of expression; the cheek flapped to and fro with respiration; he could not whistle, nor move the jaw from side to side, and had some difficulty in swallowing; his articulation was very imperfect; he had to make several efforts to protrude the tongue, and when he succeeded, it deviated towards the left side.

There was no paralysis of the muscles of the eyeball, or of the orbicularis palpebrarum. Pupils equal, contracted readily. Vision, sense of hearing, and smell, much impaired on the left side. Left arm and leg almost completely powerless. His excreta were passed unnoticed, but the sphincter ani retained a good deal of power. The biceps cubiti, and the hamstring muscles, were rigid. Sensation was almost entirely absent in the paralyzed parts. Heart's action tremulous. Pulse 96, full, throbbing, incompressible.

He was kept quiet in bed with the head raised, and a mixture of nitric acid and bark was ordered. Within twenty-four hours sensation had returned in some measure, and he could move his leg a little. At the end of a week he could move either of his limbs with ease, and sensation had almost returned; but he complained of pain in the head, and was unable to sleep. On March 20, he lost all desire for food, and became less able to move the limbs. Notwithstanding the free use of stimulants, he sank and died on the 23rd.

From the loss of motor power and of sensation of the left side, Dr. Todd considered that there was some lesion of the

corpus striatum and optic thalamus of the right side; and as his mental power was much impaired, it was probable that the substance of the hemisphere was also considerably affected. Dr. Todd thought there was white softening as there was no loss of consciousness at the time of the seizure, and as the power of the limbs speedily returned. That a clot was also present was shown by the muscular rigidity, but this was supposed to be a small one at the time of admission.

Examination of the body forty-eight hours after death.—Body well nourished, muscles well developed.

Cranium.—Dura mater unusually adherent to the calvarium. There was a good deal of serous fluid in the subarachnoïd space. The substance of the cerebrum was somewhat wasted, but generally of normal consistence. There was also much fluid in the lateral ventricles; the right corpus striatum and optic thalamus appeared bulged upwards, and on section a large cavity was found hollowing out the posterior part of the optic thalamus and the corpus striatum and extending some distance into the white substance of the hemisphere. This contained fluid and a tolerably firm clot. It was surrounded by softened brain tissue, which was found by the microscope to contain numerous granular corpuscles composed of minute oil globules and wasted nerve tubes, vide Plate xxxii, fig. 2. The softening extended some distance into the substance of the hemisphere as well as into the corpus striatum and the optic thalamus.

The pons and medulla appeared much shrunken, but the rest of the brain was healthy. No other organs were examined.

ORIGINAL RESEARCHES IN ANATOMY AND PHYSIOLOGY, AND MORBID ANATOMY AND PATHOLOGY.

ON SUBSTANCES DISCHARGED FROM THE URINARY BLADDER.

By Arthur Farre, M.D., Cantab. F.R.S.
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I.

ON DIPLOSOMA CRENATA, AN ENTOZOON, INHABITING THE HUMAN BLADDER, AND HITHERTO OFTEN CONFOUNDED WITH SPIROPTERA HOMINIS.

PLATES XXVII. AND XXVIII.

IN Number II of these Archives I commenced a series of papers, "On substances discharged from the uterus and vagina." That series is now interrupted by the intercalation in the present number of the first of a similar series, having for its object the elucidation of certain obscure points relating to substances discharged from the urinary bladder.

The subject selected for the present communication is one of especial interest. Forty-eight years have elapsed since the entozoon, which I propose to describe, was first noticed in one of the earliest numbers of the Medico-Chirurgical Transactions.*

Since that period no similar example appears to have occurred. Although it is possible that some of the cases on record in which worms have been said to escape from the bladder may have been of this kind. No descriptions, however, with which I am acquainted, afford satisfactory evidence that the worm referred to in this paper, has been observed in any other case.

The circumstances which have brought me into relation with this unique case are the following, viz. :—On several occasions, I visited the woman, together with her medical attendant,

* Case of a woman who voided a large number of worms by the urethra; with a description of the animals. By W. Lawrence, Esq., Med. Chir. Trans., vol. ii, p. 385, 1811.

and removed some of the worms from her bladder, so that I had personal evidence that the entozoon about to be described came from that viscus. Many of the entozoa so obtained, as well as other specimens,* since furnished to me from the same source, are still in my posession. At the death of the woman, I had the opportunity of conducting the post-mortem examination.

Several years have elapsed since the latter event, and inasmuch as the circumstances just adverted to have placed it in my power to communicate many facts and particulars not yet recorded, I am anxious to take an opportunity of making these known, especially since neither the original description of this worm, by Mr. Lawrence, nor that which many years subsequently I gave in the Library of Medicine (vol. v, p. 241, Article, "Worms"), wherein I ventured to distinguish it by the title of *Diplosoma crenata,* and claimed for it a reception among the true sterelminthous entozoa, appear to have satisfied helminthologists of its title to be so regarded.

Doubtless this hesitation has arisen first through veneration for the great authority of Rudolphi, by whom these worms were declared to be mere lymphatic concretions, forming casts of fistulous sinuses, imagined by him to exist in the bladder of the patient. And secondly, from the absence of any sufficiently precise description of the organization of this creature, as well as of the state of the viscus, from which it was expelled; information upon the latter point being obtainable by post-mortem examination only.

To supply this needful evidence; to vindicate the title of this remarkable parasite to be regarded as a distinct organism; and to point out the position which it appears entitled to occupy among the recognised entozoa of the human body are the objects of the present essay.

History of the case.—The first portion of the following history is briefly epitomised from that originally furnished at considerable length by Mr. Lawrence (loc. cit. p. 385).

Mary Pearson, aged 24, (in 1811), of a healthy and strong constitution, was seized in the winter of 1806, with retention of urine, requiring the daily use of the catheter. From the sensation of weight in the bladder, lumbar pain and numbness of the thighs which she experienced, added to the circumstance that

* The specimens extant with which I am acquainted, besides my own, are those in the Royal College of Surgeons and University College Museums. Many specimens were also formerly in the possession of Mr. Barnett and Mr. Complin, and these, together with some now possessed by Dr. Hare, I have, through the kindness of each of these gentlemen, been permitted at different times to examine.

she could seldom pass water, and then only in drops tinged with blood, it was surmised that she suffered from calculus, but, upon the introduction of a sound none could be detected.

After passing a considerable time in two hospitals, where the catheter was used twice daily, and where the same opinion of her cure was entertained, she passed in the summer of 1809, to the care of Mr. Barnett. At this time she exhibited symptoms of considerable constitutional disturbance. She had become emaciated; suffered much pain and burning heat in the bladder, and whenever the catheter was delayed longer than usual she was seized with violent convulsive fits.

Again the sound being used produced in the patient a sensation as if the instrument had struck against a ball at the top of the bladder. This was followed by a fluttering within her, as if something was moving. The constitutional derangement continued to increase, the local symptoms all became aggravated, and the repetition of the use of the sound was followed on several occasions by exceedingly violent convulsions.

In order to prevent mischief from over distension of the bladder, the catheter was, on one occasion, left in the urethra. After passing a very restless night the sensation of motion became very distressing, and, although the urine had escaped as fast as it was secreted, the bladder seemed greatly enlarged. Mr. Barnett was now much surprised on removing the catheter to find, insinuated through its orifice, what appeared to him a roundish worm, about the thickness of a piece of bobbin, an inch and a half in length, and of a white colour. Upon a repetition of this experiment, of which Mr. Lawrence also was now a witness, three worms were brought away, two of them most curiously entangled in the orifice of the instrument, and the third coiled round the end.

With a view to procure the expulsion of the worms, oil of turpentine was now administered by the mouth. The influence of the medicine after repetition became very painful and the inclination to urinate so urgent, that the patient, yielding to it, passed a pint and a half of water, containing four worms. The only natural evacuation of urine that had taken place since Mr. Barnett's attendance.

This remedy, however, producing, after a short time, unfavourable symptoms was abandoned, and now a very large catheter open at the end, and furnished with a stilette that filled the orifice while it was introduced, was employed. On withdrawing the stilette a free passage was left for the contents of the bladder. In less than half an hour, nine worms came through, with a tablespoonful of sandy matter, four of these worms being five and a half inches in length. In the course of the next few days fifty-two worms passed in the same manner in quantities varying from one to nine at a time. On injecting the bladder with turpentine and water more were brought away. The numbers varying from ten to thirteen on each occasion.

Slight motion of an undulating character was observed in some of these, but they were mostly dead; sometimes the worms she had passed through the catheter were observed as low down in the bed as the patient's feet. She continued discharging worms in much the same way until, at length, in October, of the same year, the number that had been passed was estimated, by Mr. Barnett, at not less than 800 to 1000.

The worms passed in this case were of two different sizes, and, as will be presently shown, chiefly upon the authority of Rudolphi, who was furnished with specimens of both, *were of two totally different kinds.* The larger worms were mostly from four to six inches in length. They were those passed in the manner, and in the large numbers already stated. One of these worms is represented in the lower figure of the plate which

accompanies Mr. Lawrence's Paper. It is the worm which I have designated *Diplosoma crenata*, and which forms the chief subject of the present memoir.

The smaller worms were passed on only one occasion. In this instance a portion of mucus came away, involving several small worms, from half an inch to an inch in length, which lived in the urine for three days, and moved very briskly. This worm is figured in the upper part of Mr. Lawrence's plate. It is the worm referred by Rudolphi, though with some hesitation, to the genus Spiroptera, and named by him *Spiroptera hominis*.*

The completion of the history of this case I am enabled to furnish from my own observations. The patient remained in the condition last described, with only slight variation, until the year 1836, when through the kindness of Mr. Complin (then the partner of Mr. Barnett), to whose care she had passed, I had the opportunity of repeatedly seeing her. She was then an occupant of the workhouse of St. Sepulchre, bed-ridden and, though yet only forty-nine, having the appearance of premature old age. The catheter with the open end was still constantly employed, and no urine was passed without it. When warm water was occasionally injected through this, a few worms of the larger kind still passed. They were not, however, usually now so large as the earlier specimens, although they presented otherwise the same characters, but in a less marked degree. Seldom more than two or three were now obtained at any one time.

In addition to the worms, I also procured in the same way numerous, round or angular bodies, of the size of small pin's heads, which, on several occasions, passed through the catheter along with the urine. I have satisfied myself by repeated careful microscopic examination that these possess the unquestionable characters of true ova.

Finally, the ova first, and then the larger worms, ceased to be passed, the smaller ones having been evacuated on only one occasion, which as already stated, was previous to my first acquaintance with the patient. And at length after suffering thirteen years more of the same kind of bed-ridden life, the catheter having been required to the last, the patient died, July 10, 1849, of apoplexy and paralysis.

Through the kindness of Mr. Complin, I was enabled to

* It is important that this fact of the passage of two kinds of worms should be specially noticed, because much misapprehension appears to have arisen through ignorance of this fact, and by consequence the two worms, though so different in structure, have been often confounded together under the same name.

make the post-mortem examination. This was a matter of great importance, both on account of the opinion expressed by Rudolphi* that the larger worms were not entozoa at all, but were probably only lymphatic concretions, or casts of fistulous sinuses which he imagined to exist in the bladder in this case, and also because it was possible that, although the worms had long ceased to be passed, still some light might be thrown upon their original seat or source. The examination disappointed any such expectation, at least, in so far as it furnished only negative results. But it had this advantage, that it served to refute the conjecture, hazarded by Rudolphi, respecting the existence of fistulous passages. No such sinuses were any where found, nor any trace of such having previously existed. The most careful scrutiny of the whole urinary track, including the kidneys, ureters, bladder, and urethra, made both at the time, and afterwards, when the parts were preserved in spirit, disclosed nothing but the most perfect and healthy condition of all these parts.

It is only necessary to add to the foregoing facts, collected from Mr. Lawrence's history and from my own observations, a brief notice of the statements of Rudolphi respecting this case.

Rudolphi, as he informs us,† in 1816, received from Mr. Barnett, through a mutual friend, three phials, containing respectively specimens of the three substances passed in this case, viz., the ova, and the larger and smaller worms.

1. The ova were declared by Rudolphi to be lymphatic concretions.‡ I have already stated, however, that they possess the characters of true ova, and I reserve for a future communication both the evidence upon this point, and also any observations that may appear called for as to the probable independence of these ova, or their relation to either of the other substances.

2. The larger worms were also declared, by the same authority, to be lymphatic concretions,§ formed in supposed fistulous passages. The evidence afforded in the present communication will, it is hoped, not only suffice entirely to refute this statement, but also to confirm the opinion which I have elsewhere|| long ago expressed as to the true animality and zoological position of this entozoon.

* Entozoorum Synopsis. C. A. Rudolphi. Berol. 1819, p. 251.

† Loc. citat. 250.

‡ Ovula vero sic dicta concrementa sunt lymphatica in vesica morbosa ex humoribus alienatis ibidem secretis, simili forsan modo ac arenulæ ex lotio præcipitata. L. c. p. 251.

§ Concrementa sistunt lymphatica sinubus vel ductibus fistulosis vesicæ originem debentia. Lympham in canalibus fistulosis coactam passimque compressam filum inæquale efformare crediderim. L. c., p. 251–2.

|| See Tweedie's Library of Medicine, vol. v. loc. cit.

3. The smaller worms furnished to Rudolphi were of the kind which, as already stated, were passed on one occasion only. This constitutes the Spiroptera hominis of Rudolphi, who found it to be a true nematoid worm. The specimens submitted to him were both male and female. They were from eight to ten lines in length, and, besides the generative organs characteristic of each sex, were furnished with a distinct alimentary canal, mouth, and anus. These features, as well as the great elasticity (Rudolphi) and semi-transparency (Lawrence) of these smaller worms prove that they were widely different, in general character and organization from the larger kind. Hence it seems difficult to account for the circumstance that these two have been very often confounded together. Such confusion may have arisen partly from want of reference to Rudolphi's original account, and partly from the fact, that while none of the smaller worms (originally few in number) are now extant, at least in this country,* specimens of the larger kind, derived from the same case, are still tolerably abundant, and have been in some instances preserved, under the impression that they were examples of Rudolphi's Spiroptera.†

Thus it appears that the same case has furnished two distinct forms of worms, both previously unknown as parasites of the human body, and of these one only has been as yet received into the category of true entozoa.

The description which follows applies to the larger worm only, the generic and specific characters of which may be thus given:—

Genus. Diplosoma. (Mihi.)

Corpus molle, fibrosum, teretiusculum, utrinque attenuatum in medio constrictum anguloque acuto inflectum; os, tractus intestinalis, anus, genitalia, nulla.

Diplosoma crenata

D. Margine membranoso crenato.

Hab. In hominis vesica urinaria.

This worm, Plate XXVII, fig. 1–3, is of tolerably firm consistence, and of a dull white or yellowish brown colour. It measures from four to six or even eight inches in length, and from one to two lines in thickness. The earlier specimens were of the larger, and the later almost all of the smaller dimensions. It is thinnest in the middle where it is bent upon itself at an

* Possibly those sent to Rudolphi may be still preserved.

† See for example the preparation of *Diplosoma* in the Museum of the Royal College of Surgeons. No. 174, A. Nat. Hist. Series, lettered *Spiroptera*.

acute angle, so that the two halves hang nearly parallel, and give to the entozoon an appearance as of two worms tied together by their heads. As this is a constant and very striking feature, and is evidently not dependent upon accidental conditions, but arises from a peculiarity of construction, I have selected it to characterise the genus. Diplosoma, διπλοος, duplus, σῶμα, corpus.

At the point opposite this angle there is often a rough surface, Fig. 4, as if at this part there had been a point of attachment, which had been broken, but in other cases, and especially in the smaller specimens, instead of a rough surface, there is here only a sharp twist, like a kink in a rope. Fig. 3.

From this central point the body gradually swells out towards the extremities, but contracts again within half an inch of either end, and terminates in some cases in a pointed extremity, and in others in a ragged end, which is occasionally furnished with a loose membranous flap. Fig. 1.

The upper or dorsal surface is convex. Fig 8. The under or ventral, fig. 6, 7*a*, is formed usually of two planes meeting in an obtuse angle, and leaving between them a longitudinal groove. Or the ventral surface is plane, but furnished with a similar groove. So that a transverse section of the worm presents usually a more or less trigonal or tetragonal outline, especially in specimens contracted by long preservation in spirit. In the abdominal groove lies often an interrupted narrow strip or band of a delicate corneous structure.

Along the line of junction of the dorsal and abdominal surfaces, there runs on the outer side a delicate membranous border, the margin of which is beautifully crenate, and upon examination with a moderate magnifying power, the crenations themselves are seen to be again crenate. Fig. 5, 6, and 7, *a*, *b*, *c*. A similar margin, less pronounced, is often observed upon the opposite lateral border, fig. 6, and 7 *d*, but the two sides are rarely equally fringed.

The worm is solid throughout, and formed of a nearly homogeneous parenchyma. It presents no trace of an alimentary canal, nor is it furnished with either mouth, anus, or generative organs of any kind.

Although there is, as is usually the case in the sterelminthous entozoa, no distinct integument,* none that can be dissected off and separately displayed, yet the external surface presents a peculiar tegumental structure. The principal fea-

* This is one of the circumstances which was considered by Rudolphi as militating against the admission of this substance into the class of entozoa, for he observes, Tota undique substantia homogenia, nuspiam cute tecta, quod me

tures of this are shown in fig. 18. Under an amplifying power of 100 to 200 the nucleated cells, composing the outer surface are observed arranged in groups, between which little furrows ramify as in the bark of an elm-tree. These groups of cells lie upon a scarcely perceptible basement membrane, which is thrown up into longitudinal ridges, composed of narrow bundles of simple nearly inelastic fibres of a white fibrous tissue. These traverse the length of the worm, after the manner of sticks in a faggot, and serve to support the cells and hyaline basement membrane just mentioned.

In order to strengthen these longitudinal fibres, others somewhat coarser and more prominent are arranged cross-wise, running round the body, like the cords which bind up a sheaf or bundle. Fig. 18.

Examined with a higher power (× 420), these cells, $\frac{1}{1000}$ to $\frac{1}{4000}$ inch in diameter, are seen filled with minute granules, each cell usually containing also a nucleus. Fig. 15.

When sections are made deeper in the substance of the worm, this part is found to be composed of white fibres, of a slightly elastic kind, inclining chiefly in the longitudinal direction. They are not united by any intermediate substance, but intermixed with them are many small granules, and occasional cross fibres. Fig. 17.

In the deeper parts of the body, as well as in the superficial cross bands of integument, and also attached to the corneous strip, are numerous fibres of a very peculiar appearance. These have, to a certain degree, the character of voluntary muscular fibre, and probably are of that nature. Each fibre consists of numerous fine elementary cords of sarcous substance, enclosed in a translucent sarcolemma, the whole bundle so constituted being thrown into numerous sharp zig-zag folds, which produce an appearance of transverse markings. Fig. 14. Examination with a high power (× 450) discloses the true nature of this appearance. Fig. 16.

The same appearance is observed also in the fibres of which the fringed and crenate margin is composed. Fig. 12, and 13 *a. b.* But here the fibres are of a finer character, and the zig-zag arrangement is still closer, so that these fibres require a very careful examination, in order to discover that this appearance results from angular foldings, and not from exactly parallel transverse markings as in ordinary voluntary muscular fibre. Fig. 13 *c.*

judice argumentum crucis est. Nullum enim datur entozoon, cui cutis denegetur; quodque coctum albumen nudum referat. But the microscope in Rudolphi's day was not capable of resolving such a structure into its constituent elements.

On one occasion, in dissecting into the substance of the worm near one extremity, I came upon a slender white cord, arranged like a nerve with one or two branches, running longitudinally. Fig. 9. Not having at that moment a microscope at hand, I could not determine its nature, and I have not since observed this structure.

In several specimens numerous shining tendinous-looking bands of fibres were observed crossing the abdominal aspect of the worm, near the extreme ends of the body. Fig. 1. These are composed entirely of inelastic fibres of white fibrous tissue.

The only remaining structure discoverable in this singular entozoon is a slender corneous band occupying the groove on the abdominal aspect of the body. This, which is perhaps the most remarkable of all its component structures, is not a constant feature. In some specimens, and especially in the smaller ones, it is often imperfect, or altogether absent. When present it always occupies the position above stated, either extending the whole length of the worm or only to a short distance, in which case it is usually found near the extreme end. It is firmly attached to the flesh, and when torn out many of the zig-zag muscular fibres are brought away with it. Fig. 10. It measures $\frac{1}{3}$ to $\frac{1}{2}$ line in breadth and is of the thickness of ordinary writing paper. It is of a brown or deep gamboge colour, and possesses considerable strength and toughness. It may be regarded as a fragmentary dermal skeleton serving to give support and strength to the soft body of the worm.

Examined with a moderate amplifying power, this structure is seen to be thickly occupied with numerous very close-set spots, fig. 10, which at first appear like small pores, but which, with a higher power, are at once resolved into cells, lying in a single plane, and though presenting some resemblance to cartilage cells, yet having peculiar characteristics of their own.

Each cell has the form of two watch-glasses apposed at their edges, and is either round or ovate. The cells are empty or contain very minute granules, mostly adherent to their inner surface. A very minute bright spot in the centre of many, but especially of the larger cells, appears to be a pore or orifice (possibly, however, a nucleus). Fig. 11.

A great number of the cells may be observed in various stages and degrees of spontaneous fission. The division may start from one side and extend to the central pore, and then pass through the complete cell, dividing it into two. When this process is complete, the two resulting cells may in many places be seen lying in close apposition. Some of the lower cells exhibit a stellate margin similar to that often observed

in blood disks whilst drying. The smaller cells are in some instances arranged in a close linear series, as in the dark line observed extending down the centre of fig. 10.

With regard to the position of this worm in the zoological series, it ought, in my opinion, as Professor Owen* has already hinted, to be placed among the lowest of the Sterelminthous entozoa.

If speculation is allowable as to the manner of subsistence of this singular parasite, we may conjecture that, since it is entirely destitute of mouth and alimentary canal, an arrangement which, in a creature living in urine, will not perhaps excite surprise, nutrition must have been effected most probably by imbibition of this fluid, or of some of its selected constituents, by means of the nucleated cells forming the outer or tegumental layer of its body. And that thus materials were supplied for the growth of the very simple elements of which the solid parenchymatous texture of the worm is composed.

That this entozoon possessed certain powers of spontaneous motion is several times stated in the history, and this power it probably enjoyed by virtue of the peculiar form of muscular fibre, apparently of the voluntary kind, what has been described.

As to the origin of the worm, it would perhaps only embarrass a subject already sufficiently obscure, to offer a conjecture here. As no trace of reproductive organs of any kind could be discovered, its origin and mode of propagation must remain a matter of pure speculation.

The patient herself, on one occasion in conversation with me, ascribed the commencement of her illness to drinking water from a certain tank or well. Mr. Complin, however, thinks that she used to trace it to sleeping in a hayfield.

In whatever light this case is viewed it constitutes a remarkable example of an individual in rude health becoming a prey to two distinct entozoa, neither of which have been known to inhabit the human body before or since, or, indeed, to have existed in any form, one of them being of so unusual a structure that the most distinguished helminthologist of his time, without hesitation, denied its animality. While not less remarkable is the record of the sufferings of this unfortunate individual, all the best portion of whose life was embittered, and who was finally brought to a premature old age and death, through the influence of this singular parasite.

* See his article "Entozoa" in Todd's Cyclopædia of Anatomy and Physiology, vol. ii., p. 124.

ON SOME POINTS IN THE ANATOMY OF THE KIDNEY OF MAN IN HEALTH AND DISEASE.

By Lionel S. Beale, M.B., F.R.S.

II.

ON THE STRAIGHT VESSELS (VASA RECTA) IN THE PYRAMIDS OF THE KIDNEY.

THE origin of the numerous straight branches of vessels (vasa recta) in the medullary portion of the kidney has been described differently. It has been held by some that these vessels were derived directly from the artery, while others have been led to infer that they arose from the efferent vessels of Malpighian bodies. The latter view was held by Bowman, who considered that all the blood carried to the kidney by the renal artery passed through the capillary vessels of Malpighian bodies, with the exception of a very small quantity which supplied the capsule. Professor Virchow has lately published some researches with the view of proving that many of these vessels do come off directly from branches of the artery.* Virchow considers that the circulation in the medullary portion of the kidney is more free than in the cortex, in consequence of the blood in this region not passing through Malpighian bodies. He thinks that the secretion, as it passes down the straight portion of the uriniferous tubes, becomes concentrated, and thus accounts for the deposition of solid crystalline matter in this part of the kidney. In diseases of the kidney, in which the circulation through the cortex is impeded, the blood may circulate through these straight vessels, and thus be carried off by the renal vein without passing through Malpighian bodies at all. When these vessels are congested, albumen, fibrin, and blood may escape, and Virchow believes that it is in this part of the organ that the different forms of casts of uriniferous tubes are principally formed, and that in this situation the causes of many morbid conditions of the kidney will be found. These observations are of great importance in connexion with morbid conditions of the kidney, and as the views

* Einige Bemerkungen über die Circulations-Verhältnisse in den Nieren. Von Rud. Virchow.—Virchow's Archiv. Band. XII.

put forward differ from those generally held by observers in this country, it is very desirable that the question should be further examined.

Although my observations fully bear out many of the conclusions arrived at by Virchow, who used opaque injections, I was quite unable to satisfy myself of the arrangement by examining such specimens. There was always a confused appearance, and it was very difficult to make out, at all clearly, the course and destination of an individual vascular trunk, especially when the specimen was dried and mounted in balsam. Many of the drawings appended to Virchow's paper are by no means so clear with regard to this point as could be wished. It seemed to me, therefore, desirable to investigate the subject in a somewhat different manner, in the hope of ascertaining exactly the nature of the arrangement in question.

The preparations from which my observations have been made were injected with the transparent blue injection,* and immersed in glycerine. Thus the tissue is made very transparent, and the manner in which the vessels are arranged can be more easily determined than by examining opaque injections, which often appear very confused, and in most cases it is quite impossible to trace the course of a single vessel. Another advantage of this mode of preparation is that the vessels on several different planes can be seen in one specimen.

The branches resulting from the subdivision of the renal artery lie in the interval between the cortical and medullary substance of the kidney. Many of them pursue a more or less horizontal course for some distance, and divide into branches which pass towards the surface of the kidney, giving off on all sides small branches which supply Malpighian bodies. In the medullary substance are numerous bundles of nearly straight vessels which pass towards the *apices* of the cones, and communicate with capillaries from which the blood is received by numerous venous radicles, which pursue a similar nearly straight course towards the *bases* of the cones. As the larger branches of the artery and vein lie between the cortex and medullary portion of the kidney, the blood must circulate from this point in two directions in the arteries,—outwards towards the surface,—inwards towards the apices of the pyramids, and in the veins, of course in opposite directions.

Most of the straight vessels may be traced backwards to the efferent vessels of Malpighian bodies (Plate XXIX, figs. 2, 3, 4, 5, &c.), but some appear to be quite unconnected with them,

* The composition of this fluid is given in a paper on "Injection," page 18.

and to be derived directly from the artery. (Figs. 1, 4*b*, 10, 11.) Sometimes the single efferent vessel from the tuft pursues a very long tortuous course, and there is the greatest chance of its being divided in making the section, fig. 4*c*, so that unless the vessel be actually traced to an arterial trunk we must not conclude that it was unconnected with a Malpighian body. It is necessary to examine a great many specimens cut in various directions to demonstrate the origin of these straight vessels.

That many of these vessels actually come off from arterial trunks, as Virchow states, there cannot, I think, be much doubt. Often there are two, three, or even four branches of the artery running close to each other for some distance, which at last terminate in these straight vessels, or anastomose with other branches, fig. 1. The horizontal branches often anastomose, and very frequently one horizontal vessel given off from a large trunk anastomoses with one springing from another. Thus a communication between many of the larger branches is established in this part of the kidney, and in case of obstruction of the trunk of an artery, the circulation through its tributaries would still be maintained. In fig. 1, near *a*, this point is very well seen. In case the Malpighian arteries should be obstructed, it is obvious that much blood would be carried off by the horizontal branches communicating with the straight vessels of the pyramids. In ordinary injections many of these branches are not filled at all, so that they are not observed, and I have reason for believing that in the preparations from which my drawings have been made, many vessels are not injected. In cases of disease, where the circulation through the cortical portion of the kidney was interfered with, the greater part of the blood would pass down the straight vessels in the cones, and would be returned by the veins. These straight vessels in disease gradually become enormously enlarged, and their coats thickened, and the capillaries themselves become as large or larger than the straight vessels are in health. I have noticed in some cases, the long nearly straight tube with numerous transverse markings throughout its entire length. These are evidently circular muscular fibres, and sometimes from their increased thickness they form quite a projection in the interior of the vessel. This fact proves that some of the so-called *vasa recta* have the structure of small arteries, and it is to the firmness of their coats, in great measure, that the well-known hardness and density of this part of the kidney, as compared with the cortical portion of the organ, is due.

In certain cases as Virchow has suggested, much fluid and albumen permeate the coats of these vessels, and pass into the

straight portion of the uriniferous tubes, and there can be no doubt that in some instances, when the Malpighian bodies are completely altered in structure, and the convoluted portion of the uriniferous tubes much changed, other constituents of the urine are separated from the blood in this region. At the same time I cannot think with Virchow, that casts of the tubes are, for the most part, formed in the straight, and not in the convoluted portion of the uriniferous tubes. That some casts are formed there, seems probable, from their size and form;* but at the same time the evidence in favour of casts being formed very generally, (and Dr. Johnson, I believe, thinks universally), in the convoluted portion of the uriniferous tube, cannot easily be overthrown. The majority of English physicians, who have followed Dr. Johnson in studying this subject I am quite sure agree with him, in the opinion that the character of the cast is a question of great practical importance, because in many cases the exact condition of the *secreting* or *convoluted portion* of the uriniferous tube, at the time of its formation can be predicated. If the cast be formed in the straight or *ductal* portion of the uriniferous, we can, of course, gain no information with respect to the character of the epithelium in the convoluted or *secreting* part of the tube. In this country, for some years past, the diagnosis of many renal diseases has been based on the characters of the casts met with in the urine, and I doubt if any modern researches have contributed of late years more real service to practical medicine, than Dr. Johnson's investigations. Again, in not a few instances, the casts themselves have been actually seen in the convoluted portion of the uriniferous tubes in post-mortem examinations, and this portion of the tube has been often observed distended with blood. The epithelium in the convoluted part of the tube in cases of fatty degeneration of the kidney, both in man and animals may often be observed to be quite filled with oil globules, while that in the straight part is perfectly clear, and transparent, and contains only delicate granules, as in health. Before death, many casts have been present in the urine, with numerous fat cells, entangled in the meshes of the coagulable material, exactly resembling those found after death in the secreting part of the uriniferous tubes. Such evidence can be obtained, almost at any time, in a London Hospital,† and it

* "Illustrations of urine, urinary deposits, and calculi," p. 39.

† In this country, particularly in London, kidney disease, and especially fatty degeneration is much more common than on the Continent. In a small hospital, a week seldom passes without several such cases presenting themselves for admission.

seems to be quite conclusive as to the importance of the character of the casts in the diagnosis of kidney disease, and proves, incontestably, that casts of moderate diameter (about 1-700th of an inch), and of small diameter (about 1-1000th of an inch), are formed in the convoluted portion of the uriniferous tube. Many of the large straight casts are no doubt developed in the straight portion of the tube. It has also been shown that blood, at least in numerous cases, escapes from the capillaries of the Malpighian bodies.

With regard to the deposition of insoluble salts in the straight portion of the uriniferous tube, almost the only solid urinary deposit, as far as I can ascertain, which is formed in the kidney at all, is that composed of dumb-bells of oxalate of lime, and occasionally phosphates. Octohedra of oxalate of lime, uric acid, urates, phosphates in most instances, cystine, &c., are deposited after the urine has left the uriniferous tubes altogether.

Although, therefore, my observations fully confirm those of Prof. Virchow, with regard to the origin and arrangement of many of the straight vessels of the pyramids of the kidney, I can only in part agree with his conclusions with reference to the action of these vessels in diseased states of the organ. There can be no doubt that, as he has suggested, in conditions where any obstruction exists to the free circulation through the Malpighian bodies and vessels of the cortex, much of the blood sent to the kidney, regains the renal vein, by passing through the *vasa recta*, or straight vessels of the pyramids which spring from arteries, and it is very possible to suppose cases of disease, in which, for a short time previous to death, scarcely any blood passed to the cortex. As I have shown, however, there seems no convincing evidence in favour of the view that blood and albumen escape in the majority of cases into the straight portion of the uriniferous tubes, or that, as a rule, casts are formed here, and not in the convoluted portion of the tube. All the evidence which I have been able to collect points to the secreting or convoluted portion of the tube, as the seat of the formation of casts (with the exceptions previously alluded to), and the vessels of the Malpighian body, as those through which, for the most part, the albumen of the blood transudes, and by the rupture of which, blood corpuscles escape into the uriniferous tubes. Again, there seems to me no evidence to show that absorption takes place in the straight portion of the tubes, and I doubt if any change whatever occurs in the density of the urine, after it leaves the convoluted part of the tube. Surely the wide channel, the direct and straight course of the tube in

the pyramid, the firm structure of this portion of the kidney, and the thickness of the vascular walls, are all conditions unfavourable to the passage of fluid from the tube into the blood, while, on the other hand, they would seem to favour very much the rapid escape of the secretion from the gland structure, as soon as possible after its formation.*

* See some remarks on the comparison between the anatomical structure of the liver and kidney. "The anatomy of the liver of man and vertebrate animals."

REMARKS ON THE FORMATION OF CERTAIN URINARY CALCULI AND OF THE DUMB-BELL CRYSTALS OF OXATATE OF LIME.

By Lionel Beale, M.B., F.R.S., &c.

SOME time since I was surprised to find, in an abundant deposit of octohedra and dumb-bells of oxalate of lime, some comparatively large oval crystalline masses, of which two are represented in the "Illustrations of Urine Urinary Deposits and Calculi." (Calculi, plate I, figs. 2 and 3.) I had often met with in other cases, small collections of three, four or more dumb-bell crystals, but had never seen before a crystal resembling one of those figured (fig. 2). All the different forms occurring in the present case, were evidently composed of the same material, as they possessed the same refractive power, and were insoluble in acetic acid and potash. These larger masses might then be looked upon as minute oxalate of lime calculi, formed in the same manner as the dumb-bell crystal. In not a few instances, microscopic calculi were met with in the sediment from the same specimen of urine, presenting almost every transitional stage between the dumb-bell and the small but perfectly formed calculus above referred to. The dumb bell then, being the origin of this small calculus, and the latter clearly an early stage of formation of the ordinary calculus, it becomes interesting to ascertain the precise seat of the formation of the dumb-bell and circular and oval crystals, all of which I regard as very minute microscopic calculi.

The above urinary deposit seemed to me a very highly interesting one, as in it I was enabled to study urinary calculi

at the most important time of their history, namely, at the earliest period of their development. It is well known, that the octohedra of oxalate of lime are commonly developed in the urine after it has left the organism; and if urine which contains very minute octohedra be allowed to stand for a few days, these may often be observed to increase in size, until at length they become very large crystals, while at the same time a number of new ones are developed. On the other hand, dumb-bell crystals are present in the urine when passed, and they do not increase in size or number if allowed to remain in the urine. These dumb-bell crystals seem to be formed in the uriniferous tubes, as the following evidence will show, and probably the greater quantity of the material of which they consist, is deposited in the straight portion of the tubes in the pyramids. In a case of Cholera, after many hours' suppression, the urine contained a little albumen, with a few casts of the uriniferous tubes. Many of these casts contained dumb-bells. Octohedral crystals were found in small number in the surrounding fluid, but not one was to be detected in the cast. (Illustrations, Plate XXII, fig. 1.) It is probable that where octohedral crystals are met with, connected with casts, they are deposited merely upon the surface of the cast, after the urine has been allowed to stand for some time. I have seen many times a number of these dumb-bells impacted in the tubes of the kidney, especially in the pyramids. Indeed if thin sections of this portion of human kidneys be made, these dumb-bell crystals will be observed not unfrequently. Often several may be seen in the wide portion of the tube, just before it opens upon the surface of the mamilla. Although I have here chiefly spoken of dumb-bell crystals, it must be borne in mind that many different forms are included under this head. The various forms of these dumb-bell crystals are given in the "Illustrations," plates XI and XII; and also in "The microscope in its application to practical medicine," 2nd Edition. I have met with a great many specimens of urine containing dumb-bells, but have been unable to associate the appearance of these crystals with any particular morbid condition. It may be interesting to refer to a few of these, which occurred in the Hospital some years ago. During six months I met with ten or eleven cases, in which these peculiar crystals were present, out of about 400 cases in which the urinary deposit was examined; but I have not observed that the urine containing them possesses any characters by which we might be led to suspect their presence, before resorting to microscopical examination, and from my own observations, it does not appear that the dumb-bells are connected with any

peculiar form of disease, or with any particuliar diathesis. They occur usually mixed with the ordinary octohedra of the oxalate, but I have found them alone; frequently they are accompanied with urate of ammonia and crystals of uric acid, and often with both. Out of ten cases in which they were present, eight were men, and the remaining two were women, above the age of 21. Of these ten cases, nine occurred between the months of September and January, and one in April, but this may be accounted for by the fact, that during the winter I have always made a much greater number of microscopical examinations than during the summer months. It may prove interesting to give a list of the cases in which these dumb-bell crystals, or crystals allied to them in form, occurred. They were present in

One case of chorea.
Two cases of cholera.
One case of chronic rheumatism.
One case of contraction of the skin of the neck and upper extremities, the condition to which the term "hide-bound" has been applied.
One case of boils, occurring in various parts of the body.
One case of paraplegia, depending upon diseased vertebra.
One case of attempted poisoning by taking half an ounce of oxalic acid.
One case of eczema.
One case of epilepsy.

Out of these ten cases, in which the dumb-bell forms of crystal were present, it will be observed that only two instances occurred in which they were found in the urine of patients afflicted with a similar disorder, and it is somewhat curious, that these should be cases of cholera. The nature of the other cases differ so entirely from each other, that it appears difficult to suppose that this curious form of crystal is any way dependent upon the nature of the malady, but we are rather led to conclude, that these crystals arise from certain conditions in the secreting action of the kidney, unconnected with any particular disease. The dumb-bell crystals often occur in the urine of persons not suffering from any special disorder at all, who consider themselves in good health; but generally there is languor and loss of appetite, with uneasiness after eating, and the individual, without being able to give an account of any particular ailment, complains of not being quite well. Dumb-bells often occur in cases where little exercise is taken with a full diet, and small

quantity of fluids. The concentration of the fluids, and the imperfect oxidation, are probably causes of the formation of these crystals in cases of cholera.

I propose now to consider briefly the characters of some of the small calculi found in the specimen of urine above referred to. Sometimes several dumb-bells adhere together, forming an irregularly shaped mass, which gradually becomes smooth by the deposition of the same material in the interstices, until a small, nearly spherical or oval, mass is formed. In other cases, it would appear that one or two crystals grow at the expense of the rest, and a perfectly uniform oval crystal, composed of course of numerous acicular crystals, radiating from a common centre, results. Thus the dumb-bell crystal becomes the nucleus of a small calculus, and it is easy to see how this may increase in size by the deposition of new matter externally,—at first, while it remains in the straight portion of the uriniferous tube, or in that system of irregularly shaped cavities at the apex of the mamilla, formed by the convergence of several of the large tubes,—then in the pelvis of the kidney or ureter, and, lastly, in the bladder itself.

Chemical Composition of the Dumb-bell Crystals.—The chemical composition of these crystals has long been a matter of dispute among chemists, but it may now be regarded as nearly certain that they consist of oxalate of lime; for since it has been shown, that the dumb-bell may gradually grow into a small calculus, and that the latter is composed of oxalate of lime, it follows that the dumb-bell, or *microscopic* calculus, has the same chemical composition. The chemical composition of these crystals has long been questioned by different authorities. As is well known, Dr. Golding Bird concluded they were composed of oxalurate, and not oxalate of lime. Dr. Thudichum brings forward evidence to show, that they consist of oxalate, and overthrows the validity of Dr. Golding Bird's objection to this view of their composition. The argument I have brought forward, cannot but be regarded as strongly in favour of the conclusion, that these curious crystals consist of oxalate of lime, although their composition has never been ascertained directly. (The statements made as to these crystals being composed of uric acid, can only have arisen from the most erroneous observations, seeing that they are quite insoluble in potash, while all forms of uric acid are readily dissolved by this reagent.) For no difference in chemical character, refractive power, or in the action of polarised light, can be detected between the minute dumb-bell and oval crystal, and the largest masses present in the specimen of urine, referred to in the com-

mencement of this paper. There could not, in fact, be the slightest doubt of their being the same substance, in different stages of growth. Nor could there be any question of the latter being, in their turn, an early condition of the small renal oxalate of lime calculi.

Upon examining a few uric acid and other calculi, I have found a small nucleus, composed of oxalate of lime. I believe that future observations will prove, that in the great majority of instances, the formation of the calculus commences by the development of a small mass composed of oxalate.* The deposition of successive layers of uric acid, urate of ammonia, phosphate, oxalate of lime, &c., is to be referred rather to the state of the urine in which the solid body lies at the time, than to the persistence of those conditions upon which the first formation of the calculus depended. Any foreign body in the bladder of a person in good health will soon become incrusted with some of the least soluble of the urinary constituents.

It is well known, that under certain circumstances, urine undergoes a kind of acid fermentation, which favours the precipitation of uric acid, or urates in an insoluble state. The precipitation of octohedra of oxalate of lime, and of triple phosphate, depends upon certain changes taking place in the urine after its secretion. The dumb-bell form of oxalate of lime is almost the only substance which is precipitated in an insoluble form, during the secretion of the urine, and in that part of the kidney which must be regarded as the secreting portion of the gland. In some cases, the small phosphatic calculi, which are occasionally met with in great number in the kidney, may be observed to possess a nucleus, composed of mucus or of epithelial particles and epithelial débris. The nucleus of others seems to consist of granules of earthy phosphate aggregated together, and converted into a small mass by being mixed with a little mucus. The phosphatic calculi which are so often met with in the prostate are also very frequently formed round a nucleus, consisting of a few cells of epithelium; and a considerable quantity of organic matter is deposited with the earthy salt. If these calculi are dried, the organic matter of course shrivels up, leaving in the centre a small cavity. The dumb-bell crystal may then form the nucleus of an oxalate of lime, of a uric acid, of a phosphatic, or other calculus.

Dumb-bell crystals have been detected in the urine at all periods of life, and I have seen them in the uriniferous tubes

* Since this paragraph was written, I have obtained several dumb-bell crystals from the nucleus of uric acid calculi, by acting upon them with potash.

of the newly born child. These curious crystals are much more common than is generally supposed, but in consequence of their being present in the urine of a person only for a few days at a time, they often escape observation altogether. Without doubt there are many cases in which dumb-bell crystals escape from the kidney without the formation of a calculus. These crystals are so minute, that there is every chance of their passing off in the urine; but should they be produced in persons whose urine is in a state in which deposits are readily formed, it is very likely that a collection of them should become covered with the insoluble material, and thus a small calculus becomes formed, which, if still retained, will gradually increase until it obtain a considerable size. In cases, therefore, in which these crystals are met with in the urine, it is desirable to interfere. Their expulsion from the uriniferous tubes should be encouraged, by giving ordinary diuretics and large quantities of water, and we may endeavour to prevent their formation by recommending good air and exercise, and a good but simple and moderate diet, with small quantities of wholesome stimulants, and two or three doses of the mineral acids every day. In short, encouraging the activity of the oxidizing processes in the organism, which prevent the formation of uric and oxalic acids, &c.

The principal points advanced in this communication may be summed up as follows:

1. That the dumb-bell crystals are formed in the uniferous tube, while the octohedra are not deposited in the kidney at all, and in many cases not until the urine has left the bladder.

2. That under certain circumstances the dumb-bell crystals, if retained in the tubes of the kidney, become aggregated together, and so form the nucleus of a calculus. In other instances, a single dumb-bell grows into a small calculus.

3. The nuclei of oxalate of lime calculi, of uric acid, urate of ammonia, phosphatic calculi, &c., may be composed of dumb-bells.

4. Dumb-bells, like urinary calculi, occur at all periods of life.

5. The chemical composition of the dumb-bell is, doubtless, the same as the oxalate of lime calculus, of which it is but an early stage, and consists of oxalate, and not oxalurate of lime.

6. As it has been shown, that dumb-bells may grow into small calculi, it is very important to promote their expulsion from the kidney as soon as possible.

RESULTS OF THE CHEMICAL AND MICROSCOPICAL EXAMINATION OF SOLID ORGANS, SECRETIONS, ETC., IN DISEASE.

BLUE DEPOSIT IN THE URINE, FROM A SPECIMEN SENT

By Dr. Eade, Norwich.

THE blue deposit from urine which is represented in plate XXXII, fig. 4, was obtained from an old man of 83 years of age, who was under the care of my friend, Dr. Eade, of Norwich, to whom I am indebted for the specimen and for the following notes of the case. Considerable difficulty was experienced in obtaining the man's history, for although, for his age, he was very strong and robust, his mind was not very logical, and it was very difficult sometimes to be certain of the information he gave.

Case.—C. A., æt. 83. Tall, strong, and robust-looking for his years; formerly a soldier, but now and for many years a weaver. Has several times suffered from ulcerated legs, and four years ago had an abscess in left testis, which soon healed.

Six months ago, he rather suddenly began to suffer from a desire to pass water more frequently than usual, as often as once in one, two, or three hours, both by day and by night, the quantity passed at one time seldom exceeding a teacupful, and the urine being turbid and strong smelling.

He can assign no cause for this ailment. Never had a blow upon back or loins. Is not subject to gravel. Has no stricture. Has never suffered pain in back, belly, perineum, or thighs, but complains of a cutting pain or uneasiness at end of penis just before and during the act of micturation. Urine escapes freely, never stops suddenly during its flow. Never passed blood or small stones. Has been treated without much benefit by acids, quinine, opium, buchu and steel.

Jan. 26.—It was to-day observed that a small white chamber-pot, into which he passes his urine, was stained all round the bottom and sides of a bright blue colour. He says that this blue deposit has been present for several weeks past.—(*Note.* For several weeks his medicine has been Tr. ferri sesquichlor. and opium.) —The urine is turbid, of a dirty greenish yellow colour, highly ammoniacal to the smell, but to test paper neutral, if not faintly acid. After standing, a copious whitish precipitate occupies the lower part of the vessel, leaving a clearer portion above. Sp. gr. 1015. Coagulable with heat and nitric acid. A few phosphates thrown down by liq. potassæ. The microscope shows nothing but pus globules in large quantity.

March.—Three weeks ago had a slight temporary attack of facial paralysis. Says that but for his bladder he would now be in good health. The urine is still passed almost as often as ever. Diet consists of cocoa for breakfast and tea in the evening. Solid food, chiefly bread and butter. Seldom takes any beer.

The urine which I received was alkaline, and rather dark in colour. It contained an abundant deposit. After allowing this

deposit to subside, it was observed that the upper part was light and flocculent, and of a *dark blue* colour. The lower portion of the deposit consisted of numerous crystals of triple phosphate and altered pus globules. The supernatant fluid, after the subsidence of the deposit, was turbid, but its colour resembled that of port wine and water.

The coloured deposit consisted of several strata. The layer lying immediately upon the deposit of triple phosphate was of the colour of Prussian blue, but the most superficial part was of a dark purple hue.

The blue deposit, although when diffused through the fluid appeared pretty abundant, when collected was found to be much too small for a careful examination. It was not altered by *potash, soda,* or *ammonia,* and *acetic acid* and strong *nitric acid* produced no change.

The microscopical characters of the blue deposit are shown in plate XXXII, fig. 4. It will be observed that there are bodies of different tints. The masses with little crystalline spiculæ are invariably of a dark purple colour, but there are also a number of bodies varying in size and form, many of which seem to be made up of smaller, almost spherical masses. These are bright blue, almost of the colour of Prussian blue. It is probable, however, that they are both composed of the same substance as they behaved in the same way upon the application of reagents.

From the colour of the crystals, in conjunction with the fact that the man was taking a preparation of iron at the time, one might at first be inclined to look upon them as consisting of Prussian blue, but the colour of this substance, as is well known, is completely destroyed by potash, which reagent did not exert the slightest effect on the colour of the deposit.

The resemblance in colour of the purple crystals to indigo could not fail to strike any one who had seen specimens of that substance under the microscope. Indeed, with care, crystals of indigo may be prepared which very closely resemble some of the crystals under consideration. (Plate XXXII, fig. 3.) Although the deposit in this case was too small in quantity to permit a careful chemical examination being made, the circumstances above referred to, combined with the description of similar deposits by different authorities, are quite sufficient to justify the conclusion that it was composed of indigo. So far as I know, the microscopical characters of the deposit of indigo have never been figured before. Some of the chief varieties of the crystalline forms are represented in plate XXXII, fig. 4. The pale blue masses are marked *a* in the figure.

This blue deposit is doubtless of the same nature as one observed, many years ago, by Dr. Prout:—"I once met with an instance in which indigo was occasionally voided in the urine, in considerable quantity. The patient was a middle-aged man, of a nervous temperament. He was in the habit of taking seidlitz powders, and the indigo most generally appeared in the urine in the form of a dark blue sediment, after taking one of these powders. The quantity was so considerable on one occasion as to allow of its being collected and examined; when it was found to possess all the properties of indigo, and was obtained in a state of purity by sublimation. I had expected to find it consist of Prussian blue." *

Franz Simon alludes to a case in which the blue deposit was probably of precisely the same nature as the one in the present case. The colour did not disappear upon the addition of caustic potash. Its colour was not destroyed by dilute organic acids nor by hydrochloric acid.†

Indigo-blue or uroglaucine is sometimes precipitated spontaneously by decomposition of the urine.

It is present in small quantity in healthy urine. Heller, however, seems to have obtained it principally from morbid specimens.

The *uroglaucine* or indigo-blue is formed by the decomposition of *uroxanthine.*

Perhaps the best test for this substance is grape-sugar and potash. A little grape-sugar and potash are added to dilute alcohol, and the blue sediment is warmed in the mixture. If indigo be present the fluid loses its blue tint and becomes red. It next soon changes to a green colour.

Uroxanthine is present in small quantities in healthy urine, and in certain diseases of the kidneys and spinal cord may be obtained in considerable proportion. This uroxanthine, which is identical with indican obtained from Isatis tinctoria and some other plants, is readily decomposed into indigo-blue (*uroglaucine*) and indigo-red (*urrohodine*).

Heller obtained uroxanthine by treating urine with acetate of lead, evaporating the filtrate to dryness at a low temperature and extracting the dry residue with ether. The ethereal solution yielded uroxanthine by evaporation. The processes for obtaining uroglaucin and urrohodine are somewhat complicated, and the reader is referred for a description of the best plans to

* On the Nature and Treatment of Stomach and Urinary Diseases. 3rd Edition, 1840.

† Simon's Animal Chemistry, vol. ii, p. 328.

be pursued to Dr. Thudichum's work, pages 331 and 335. Uroglaucine is produced in urine by the decomposition of the uroxanthine, and a blue deposit is formed. Cases in which this substance has been found as a distinct deposit have been reported by several observers. Dr. Hassall has lately investigated the nature of this blue deposit in urine, and has written a very interesting paper on the subject, which is published in the volume of the Phil. Trans. for 1854, page 297.* In this communication the reader will find a statement of what is known upon the subject up to the present time. Some observations on the colouring matters of the urine will also be found in my lectures on urine, urinary deposits, and calculi, now in course of publication in the British Medical Journal (No. CXVIII, April 2nd, p. 271). [L. S. B.]

SARCINÆ VENTRICULI FROM A PATIENT WHO HAD ONLY VOMITED SHORTLY BEFORE DEATH, WHICH WAS CAUSED BY PERFORATION OF THE STOMACH.

THE specimen of vomit was sent to me by my friend Mr. Edwin Day of Acton, in whose practice the case occurred. The vomit contained a pale-brownish sediment, apparently consisting of softened bread which was suspended in a tenacious and almost clear fluid. There seemed to be no tendency to fermentation; sarcinæ were more abundant than I had ever observed before, and a number of torulæ were also present. The great bulk of the brownish sediment was certainly composed of sarcinæ. Mr. Day sent me the following notes of the case.—[Editor.]

"On opening the body an immense quantity of very offensive flatus was evolved, and on touching the stomach it immediately poured out its contents through an aperture below, and a little to the right of the cardiac orifice, so that when she was erect a considerable quantity of the contents would be retained. There was a large quantity of fluid in the cavity of the peritoneum, and some lymph on the various coils of the intestines, but they were not glued together. The liver was pale and small; the heart flabby and easily broken down with the finger; the lungs healthy; the kidneys large; capsule easily detached. The ulcer has the edges bevilled away all round, but there is no thickening. *I could get no history of vomiting.* The patient

* See also The Proceeding of the Royal Society, June 16th, 1853.

has complained for a lengthened period of pain in the side, but appeared pretty well. The day before her death, playing about with the children, and after washing up the tea-things, she was seized with violent pain in the side, and vomited several times. Her mistress applied warm fomentations, and got her to bed. Finding she did not get better, she sent for a practitioner, who was from home. She took a calomel pill and an aperient draught, but experienced no relief. In the morning, after passing a sleepless night, she was seen by a surgeon who ordered her home or to an hospital; but he did not seem to apprehend any sudden danger. I saw her at a quarter to eleven A.M.; she had just been brought home in a cab; and as she was carried up stairs, she fainted. I found her lying on her back, complaining of great pain at the bottom of her stomach, and of thirst. There appeared a swelling there, which I left for future investigation. Her bowels had not been opened for two days; her pulse was weak and slow, and the skin cold and clammy, apparently recovering from the fainting fit. She was ordered to take two tea-spoonfuls of castor oil immediately. In an hour they sent to say she was dead.

"An inquest was of course held. Mr. Wakley the coroner stated, that he had met with several instances in which sudden death had taken place from perforation without previous symptoms, and referred especially to the case of a woman at Hanwell, who swallowed a large German silver fork. For thirteen days she was apparently well;—suddenly seized with violent pain in the stomach, and died in a few hours."

NOTE ON THE PREPARATION OF DIGESTIVE POWDER FROM THE PIG'S STOMACH.

By the Editor.

IN the last number of the Archives (page 269) I described a very simple plan for the preparation of digestive powder from the pig's stomach. I tried some experiments on this subject in the hope of being able to find some simple method which might ensure an efficient preparation, and which at the same time might be readily carried out by persons living in the country. For although efficient preparations are to be obtained, many complaints have been made by practitioners of

the inertness of the pepsine they have employed. In consequence, the remedy has lost its repute to some extent. There are so many cases in which pepsine is of great value that it seems a pity we should be compelled to discontinue its use merely because it is difficult to obtain it good and at a reasonable price.

Digestive powder, prepared in the manner previously described, is now made by Mr. Lloyd Bullock, of Hanover-street. In consequence of the expense of pigs' stomachs, it is still rather costly;* but it is probable that in the course of time it will be supplied at a cheaper rate. It is only reasonable to suppose that the pig's stomach would yield a digestive preparation better adapted to the requirements of the human subject than could be obtained from the stomach of a ruminant.

URINE FROM A CASE OF VERY SEVERE LEPRA.

THE patient was a girl aged 20, who had had previous attacks which had occurred in the spring of several successive years, and had been treated according to several different plans. She first came under my care as an out-patient, but as the case was severe she was admitted into the Hospital under Dr. Johnson. At the present time she is feverish. There is loss of appetite, and some constitutional disturbance. The quantity of scales removed daily from the skin is enormous. A *dust shovel* full is swept from the bed clothes. Large flakes of cuticle, the size of the hand often peel off from the ante-

* Mr. Bullock supplies this at the rate of 2*s.* per drachm. The dose is from 2 to 4 or 5 grains. ·8 grain of this pepsine, with 10 drops of dilute hydrochloric acid, and an ounce of distilled water, dissolve 100 grains of hard-boiled white of egg in from 12 to 24 hours. In the body probably twice this quantity or even more would be dissolved in a comparatively short space of time. It is probable that in a short time the pig's pepsine will be prepared at a much cheaper rate.

Boudault's pepsine is nearly as strong; 1 grain, with the same quantity of hydrochloric acid, dissolves an equal proportion of albumen.

The Viennese pepsine (prepared by Dr. J. Lamatsch) is also very good, but it does not seem to be quite so strong as Boudault's. The same proportion scarcely dissolved a similar amount of albumen in 24 hours.

The digestive power prepared from the pig's stomach retains its activity for any length of time, if kept perfectly dry. I have some which has now been kept in a bottle for upwards of two years, and still retains its active power unimpaired. It is nearly tasteless and inodorous.

Note.—Boudault's pepsine costs about 8*s.* an ounce, and the Viennese about 12*s.* an ounce. One pig's stomach, which costs 6*d.*, yields about 45 grs. of the powder prepared as above described.

rior part of the leg. The skin beneath appears very thin, is bright red, and feels very hot. She passes about 40 ounces of urine in 24 hours; sp. gr. 1021.

Analysis 17. (July 17.)

Water	957·50	
Solid matter	42·50	100·00
Urea	15·00	35·7
Other organic matters ..	6·20	14·7
Fixed salts	21·30	50·7
Chlorides	13·00	30·9

Analysis of the scales. 626 grains were collected in 24 hours. 500 grains subjected to examination.

Analysis 18. (July 21st.)

Water	51·00
Solid matter	449·00
Ash	7·36

A small quantity of the ash was treated with nitric acid. Slight effervescence took place. To the acid solution ammonia was added, and a slight precipitate occurred (phosphate of lime). The ash consisted principally of sulphate of lime with a little phosphate.*

March 2nd. Urine of 24 hours; sp. gr. 1007 neutral.

Analysis 19.

Water	985·40	
Solid matter	14·60	100·00
Urea	5·90	40·40
Uric Acid	·45	3-08
Extractive and ammoniacal salts	·65	4·40
Fixed alkaline salts ..	7·31	50 00
Earthy phosphates ..	·29	1·90
Chlorides	5·00	34·20
Sulphates	·45	3·0

March 23rd. The patient by this time had very much improved.

Analysis 20.

Water	971·3	
Solid matter	28·7	100·00
Urea	10·5	36·58
Extraction	3·6	12·50
Salts	14·6	50·80
Chlorides	7·0	24·3

The large quantity of fixed salts, is, perhaps, the most

* Some time since, I examined the scales from a severe case of lepra (Michael Sheen, aged 24), and found that the dry scales contained 2·31 per cent. of fixed salts, of which the greater part was insoluble in a moderate quantity of water, but upon adding a large bulk a considerable amount was taken up. When this solution was concentrated, *crystals of sulphate of lime* formed.

interesting point shown in these analyses. In healthy urine the solid matter contains about 25 per cent. of saline matter, but in these specimens of urine double that quantity was present. At the same time, the quantity of urine passed was considerable. It would appear also, that the separation of so much organic matter in the shape of cuticle, had caused a diminution in the organic constituents of the urine. In these analyses, the proportion of extractive matters is unusually small. [L.S.B.]

RARE FORM OF TUMOUR BENEATH THE TONGUE OF A GIRL AGED TWENTY-FIVE.

THE tumour projected beneath the chin and extended upwards into the mouth. It had been growing for two years. It was opened by Mr. Fergusson, and about an ounce and a half, of a soft pultaceous mass was removed.

Analysis 21.
1000 grains contained—

Water	838·72
Solid matter	161·28
Extractive matter	13·44
Alkaline salts	·68
Fatty matter	45·00
Tissue, &c., insoluble	99·88
Earthy salts	2·28

The microscopical characters of the tumour were peculiar. These are represented in fig. 1 Plate XXXII. The mass was found to be composed of numerous cells, like adipose vesicles, filled with fatty matter, but some appeared nearly empty, and closely resembled cells of squamous epithelium *a* and *b*. The microscopical characters of this mass somewhat resembled those of cholesteatoma, but no plates of cholesterine were present in the specimen. In structure, however, the contents of this tumour are closely allied to the cholesteatomatous group. [L.S.B.]

LARGE PROPORTION OF FAT IN THE CORTICAL PORTION OF THE KIDNEYS OF LONDON CATS.

THE quantity of fatty matter in the cortical portion of the kidney of London cats is enormous. It has been held that this arose from fatty degeneration resulting from confinement, &c., but all the adult cats' kidneys that I have examined, have exhibited the same peculiarities. It is difficult to refer a change so wide-spread to the results of disease, especially as the cats themselves seem perfectly healthy. The proportion of fat is much greater than is ever obtained from the human kidney in a state of fatty degeneration. As this change is an interesting one, and does not occur to any great extent, until the cat is nearly full grown, I propose in a future communication to give drawings of the microscopical appearances. Now, I only wish to draw attention to the fact of the very large quantity of fat present in the cortical portion of the kidneys of London cats. The eight following specimens were taken as they came, and were not specially selected :—

	22		23		24		25	
Water	72·80		71·10		67·94		73·50	
Solid matter ..	27·20	100·00	28·90	100·00	32·06	100·00	26·50	100·00
Fatty matter ..	8·84	32·5	8·67	30·00	15·39	48·00	8·42	31·78
Animal matter ..	16·90	62·1	19·25	66·60	15·32	47·79	16·65	62·83
Fixed salts ..	1·46	5·4	·98	3·39	1·35	4·21	1·43	5·39

	26		27		28		29	
Water	75·50		78·00		72·00		73·80	
Solid matter ..	26·50	100·00	22·00	100·00	28·00	100·00	26·2	100·00
Fatty matter ..	6·67	25·16	6·95	31·59	12·15	43·39	7·86	30·00
Animal matter ..	18·46	69·68	12·99	59·04	15·29	54·61	15·67	59·80
Fixed salts ..	1·37	5·16	2·06	9·37	·56	2·00	·68	2·59

Analysis.			
22	The cortical portion of the kidney of a cat	12 months	old
23	„ „ „	15 months	„
24	„ „ „	2½ years	„
25	„ „ „	18 or 20 months	„
26	„ „ „	2½ to 3 years	„
27	„ „ „	9 months	„
28	„ „ „	2 years	„
29	„ „ „	age unknown	

It is difficult to ascertain the precise age of the cats, but looking at the results of the analyses generally, we are led to conclude that there is less fatty matter in the cortical portion of the kidney of young, than in that of old cats. Still, many

more analyses must be made before the circumstances under which this increase of fatty matter takes place, can be ascertained. I propose to consider other bearings of this question at an early period.

The following is an analysis of a human kidney in a state of fatty degeneration. The case was that of a girl about 23 years of age, and was in every respect a well-marked instance of the disease. [L. B. v. ii. p. 70.]

Analysis 30.

Water	79·650
Solid matter	20·350
Animal matter	13·436
Fat	5·490
Fixed salts	1·424

The fatty matter of the cortical portion of the cat's kidney consists partly of an oily and partly of a crystalline fat. In one experiment I found 3·46 of crystalline fat, and 4·4 of oily fat. [L.S.B.]

CASE IN WHICH THE SO-CALLED HYDATIDS OF THE PLACENTA WERE DEVELOPED ON THE MEMBRANES AT SOME DISTANCE FROM THAT ORGAN.

By W. H. Michael, Esq., M.R.C.S., Swansea.

THE placenta and membranes in this case were normal, with the exception that at about three and a half inches from the placenta there existed a patch of hydatid like bodies, about the size of the palm of the hand. The vesicles had the usual characters of the so-called *hydatids*, and varied in size from a hempseed to that of a nut. The development of these bodies is probably to be accounted for on the supposition that a few of the villous processes, which at an early period of development completely cover every part of the chorion, had remained in this situation and had been developed into the bodies above described, which, as is well known, are composed of little cysts connected with the villous processes. The position of the mass is shown at *a*, fig. 4, Plate XXX.

PROCESSES AND INSTRUMENTS OF PRACTICAL VALUE IN CARRYING OUT SCIENTIFIC ENQUIRIES BEARING UPON MEDICINE.

THE APHEMETRIC COMPASS;* AN INSTRUMENT FOR MEASURING THE DEGREE OF DISCRIMINATIVE POWER, AS REGARDS CONTACTILE IMPRESSIONS, ENJOYED BY THE SKIN AND MUCOUS MEMBRANES IN CERTAIN AFFECTIONS OF THE NERVOUS SYSTEM.

By John W. Ogle, M.D., Oxon, F.R.C.P.

Assistant Physician to St. George's Hospital, Honorary Secretary to the Pathological Society.

IN the year 1834 a pamphlet, consisting of a series of Anatomical and Physiological Annotations "De pulsû, auditû, resorptionê et tactû," was published at Leipsic, by Professor Ernest H. Weber. In one of the chapters, that entitled "De subtilitate tactûs diversâ," &c., page 44, in addition to other sections upon the perception of heat, and the estimation of the weight of bodies by the sense of touch, is one section, headed "Experimenta de distantiâ duorum corporum organon tactûs simul tangentium recte perceptâ," and in this section are several propositions or enunciations, of which three specially and directly bearing on the object of this communication run as follows.

1stly. That various parts of the body are endowed with the faculty, by virtue of the organ of touch, but not in an equal degree, of clearly recognising two substances by which they are simultaneously touched. This degree of endowment may be measured by the exact distance existing between those two substances touching the part; for this is peculiar to the organ of touch, that if it does not distinctly recognise two substances touching the skin at but a slight distance from each other, it will, nevertheless, distinctly recognise them, if this distance between them be increased to a certain limit. (Page 47.)

2ndly. That we perceive the distance and position of two substances by which we are simultaneously touched, more distinctly if they be placed transversely to the axis of the body, than when placed in the longitudinal diameter. (Page 49.)†

* From ἁφή, *i. e.* a touching or close contact; or the sense of touch, as used by Plato and Aretæus.

† This does not hold good for every part of the body.

3dly. That in those parts of the body simultaneously touched, in which the points of the compass touching are clearly recognised, although at no great distance from each other, the distance between them appears to be much greater than in parts not endowed with so exquisite a sense of touch, (*i. e.* with such discriminative power).

This last statement is remarkably well illustrated by Weber, at page 148 of his paper. He says that if the points of a compass, at about the distance from each other, of the breadth of the thumb, be brought into contact (simultaneously) with the skin of the cheek near the ear, the distance existing between them will be recognised as very small, or will perhaps not be perceived at all; but, inasmuch as the anterior part of the cheek enjoys a more subtle sense of touch, and still more the lip, especially the middle portion thereof, if the compasses be gently drawn along the skin towards the middle of the lip, its points, although maintained at the same distance, will appear to become gradually separated, in proportion to their proximity to the lip.

Moreover, the points of the compass brought simultaneously into contact with the skin, in a longitudinal direction, appear to be much closer to each other than if they are placed in a horizontal direction, as respects the axis of the body or the limb (page 151); also, points touching the skin on different sides of the median line, appear to be more distant than when they touch it on one or other side alone. Again, such points seem much more distant, and are more clearly perceived when touching *two* contiguous surfaces subjected to voluntary motion, than when they only touch a *single* one; as is shown by the difference of impression produced, by placing both the points of the compass on one lip, and by placing one point on each of the lips (page 60).

In addition to the above observations regarding tactile discrimination, many others of the highest physiological interest might be quoted from Weber's paper; but as my object here is not to render an analysis of the whole of Weber's tract, but merely to point out such salient points therein met with as may be of a more practical and clinical character, and such as more immediately connect themselves with the purposes to which the instrument which I am about to describe, is applicable, I will forbear to quote further in a direct way from the paper in question.*

* One or two points regarding the details requisite for duly and scientifically carrying out the experiments, may here be timely enjoined. For instance, as Weber observes, great stress must be laid on the fact, that the substances brought into contact with the surface of the body, should, as much as possible, be of the

In the pursuit of his observations, Weber at first made use of an instrument termed in Germany a *"Stangenzirkel,"* consisting of a long and straight piece of steel to which at right angles are attached two moveable points which may be approximated or separated in a straight line. By means of these moveable points, shielded by cork, he ascertained the exact distances or limits within which two distinct cutaneous impressions, made at the same time, are capable or not of being identified. Subsequently he adopted the steel compass of ordinary mathematical use, blunted at the points; and it was with this last instrument, of which my aphemetric compass is a modification, that his observations upon himself and others as to the contactile sensibility and discrimination of the skin were made.

Most of our physiological works give a summary of the results obtained by Weber's instrument as regards this contactile appreciation, etc.,* and therefore it would here be out of place for me to repeat them.† It may suffice to say that at the tip of the tongue and at the palmar surface of the third phalanx of the fingers‡ separate objects or points brought simultaneously into contact with the surface might be identified, having a shorter distance between them than in any other part of the body; and at the above-mentioned part of the tongue, contactile impressions resulting from two applied points, would be distinctly appreciated if on the average only distant from each other about half of a Paris line (*i.e.*, equal to about $\frac{1}{22}$th of an inch, according to English measurement).§ Whereas at the middle of the fore-

same form, material, and temperature. It is of course absolutely necessary, that the two points should be brought into connection with the skin exactly at the same moment of time, for otherwise they will appear to be at a greater distance apart than they really are, and also with equal force and pressure. Also, that the eyes of the person experimented on be closed or averted, and that no cause for distraction of the attention be in any way permitted. For a similar reason, and to prevent confusion between two distinct kinds of cutaneous impression, the points of the object in contact with the skin must not be so sharp as to inflict pain, or so hot or cold as to give the impression of difference of temperature.

* I have ventured to use the epithet *"contactile discrimination,"* substituting it for the expression "tactile sense" of Weber, because we now, I think, more clearly understand the analysis of the so-termed general tactile sense, and recognize its division into the four subordinate tactile senses of, 1st, Temperature; 2nd, Pain; 3rd, Muscular action; and 4th, Contactility, as shown by Landry and others.

† See article "Touch" by Carpenter, in Todd's Cyclopædia of Anatomy and Physiology, p. 1163; also Wagner's "Handwörterbuch" article, Nervenphysiologie, vol ii. p. 568; also Baly's "Translation of Müller's Physiology," vol. i. p. 751.

‡ In some of our authorities it is erroneously stated that Weber found the phalanx of the third finger to be the most highly endowed with this tactile discriminative power; whereas it is the third phalanx of *all* the fingers of which he speaks.

§ Even at this minute distance apart it was at this place quite possible to recognize whether the two points in contact with the surface were placed at right angles to, or parallel with the axis of the body.

arm, thigh, and back, the applied points of the compass must generally, in a natural condition, be 30 lines apart before they can thoroughly be identified.

Weber gives a very elaborate and lengthy as well as a shorter or condensed enumeration of the various parts of the surface of the body, as observed on his own person, with the qualifications possessed by each for the appreciation of double, simultaneously received, contactile impressions.* But, in addition to the examinations by Weber into the above diagnosing properties of the various parts of the skin, researches also have been made into the subject by others, and among them by G. Valentine,† as noticed in Müller's Physiology, and in the above-cited article on "Touch." Valentine, observing on his own person, as well as on that of others, found that great difference existed among different people as to this contactile recognizing power, and this I have myself also found to be the case in observations practised upon healthy individuals. Indeed I think this might be expected, *à priori*, inasmuch as people are naturally endowed with various degrees of general sensibility as regards the perception of all kinds of impressions or sensations, and no doubt the above form of tactile sensation, as well as others, will, in a normal condition, vary in keenness according to what is called the individual temperament, as well as according to education and training respective of the general and inherent perceptive powers; and to a slight degree also no doubt, even according to age, sex, etc. Moreover, the character as to thickness, consistency, &c., of the cuticular covering, doubtless modifies this power of discrimination; and I may here state that I have lately had the opportunity of testing this capacity in the person of a young lady who, owing to her having been for several years disabled as to her hands and feet by rheumatic gout, had always led an indoor life, not being able even to sew; and I found that at the tips of her fingers which were very delicate, soft, and thinly covered by cuticle, she could distinguish the impression made simultaneously by the two points of my aphemetric compass when they were less distant from each other than the nearest impressions which Weber states capable at this part of being distinguished.

* A useful synoptical diagram or chart, as it were, and one which now I am engaged in constructing, might be made of the surface of the whole integument of the body, in which the districts or regions of various contactile discriminative endowment might be mapped out, so that at a glance, and for practical and clinical purposes as alluded to later on, it might be seen how much in any given case of Anæsthesia or Hyperæsthesia this contactile sensation differs from the average acknowledged condition. I hope also to make out to what extent more impressions than two can, at the same time, be discriminated by various parts of the integument at certain stated distances apart.

† De Functionibus Nervorum Cerebralium, &c., 1839, page 118.

Valentin, as may be seen by his tables in which the discriminating power of no less than 50 parts of the surface of the human body is given, found that the same portion of the skin might in some exceptional but healthy cases be so highly endowed as to this power that impressions only separated by one-half the distance of that observed in other individuals could be distinctly perceived; and from a comparison between the native countries of those on whom the experiments were tried, he conceives it possible that climate and method of clothing may become elements in the modification of this discriminating property.

Carpenter also, in his article on "Touch," before alluded to, where distinguishing between this form of tactile discriminative power and what is called common sensibility, has said much with the intention of showing that they are distinct;* and instances the fact that the skin of the face is infinitely more sensitive to a smart blow of the finger or fillip than is that of the ends of the fingers, which greatly exceeds the skin of the face as regards this form of tactile discrimination.† Moreover, Valentin shows that in certain parts, one side of the body is more exquisitely endowed with the discriminating quality than the other, and that the temperature and degree of dryness or moisture of the surface of the skin are also modifying agents.‡ Some

* As regards what is termed general sensibility, no doubt great confusion has hitherto existed in the minds of physiologists, as Landry, in his new and erudite work, "Traité Complet des Paralysies," has demonstrated. That author points out that the cutaneous tactile sensations are not to be put in opposition to general sensibility as an abstract property, for although to be separated from the former, the latter is not an essentially different function, as many would have it, but signifies the mode of feeling extended over almost all the tissues of the body, as regards the vague sensation produced by tactile impressions not capable of furnishing a pure idea of the nature or qualities of the substances causing the impressions.

† Carpenter, as I think, may be inferred from the way in which this illustrative example is mentioned by him, had not arrived at the same conclusions regarding the analysis, so to say, of the tactile sense which Landry has developed. The latter author, whilst ignoring the existence of any substantive or special sense of touch (as may be seen in the results of his researches on tactile sensibility in the Archives Génér. deMedicine, 1852) refers all the tactile phenomena to four primitive, special, and distinct sensations, assignable to separate nervous filaments, and possessing individual and appropriate centres in the great nervous masses, *ziz.*, those of temperature, pain, contact and muscular action (*i. e.*, the sensation produced in the muscular tissues by and during their contraction). This being the case, we naturally look for their isolation and independence as well in diseased as in healthy conditions; and are not surprised to meet with instances in which one or other of these sensations alone is preëminently exalted, or diminished, or altogether paralysed in any given portion of the cutaneous or mucous surface.

‡ The tongue and fingers which rank so high as regards contactile discriminative power are less impressionable to temperature than the skin of the eyelids or cheeks, and the extremities of the fingers, so facile in contactile discrimination, are but imperfectly sensitive to painful impressions. Many other

experiments made by Rudolph Wagner* upon tactile discrimination in general, show how very exquisitely this power is possessed by the visual organs. He states that two parallel lines can be distinguished by sight if only 0·00014″ apart; and also cites the observation of Valentin that such lines may be perceived when distant only 0·00009″.

It is impossible here to follow either of these authors more completely where speaking of all the important points connected with contactile discrimination, or the statements of others on the same subject. I will only now briefly allude to three special sources which may be consulted on the subject in question; they are the observations of Dr. Allen Thompson, Dr. Belfield Lefévre, and Dr. Graves.

In the year 1833, Dr. A. Thompson contributed to the Edinburgh Medical and Surgical Journal (see for that year, No. 116) a translation of the account given to him by Weber himself, not then published, of his discoveries concerning the relative power which the skin possesses in various parts, of recognising double impressions made simultaneously upon it within a given limit. In this communication Dr. Thompson combats the supposition maintained by some that this diversity of appreciation was owing to the various parts being more or less habitually seen than others. He shows that this cannot be the cause, inasmuch as some parts which have a comparatively acute discriminative power are quite beyond the range of vision; for example, in the skin over the sacrum and coccyx this discriminative power is more acute than over the pubes. A notable proof of the truth of this objection of Dr. Thompson is the extremely exalted condition of cutaneous sensibility commonly met with in those who have been born blind. Dr. Thompson seems inclined to attribute the diversity in question to some modification of the skin as regards the method of distribution of the nerves, and the quantity of nervous matter existing in divers parts of the skin. The probability of this supposition has however been since quite negatived by the arguments of Dr. Brown-Sèquard.

Again Dr. H. Belfield Lefévre in his "Recherches sur la

instances exist in which the capacity of appreciating impressions of pain, and those of heat or contact co-exist at the same parts in more or less reverse proportions. It is then apparent that the aptitude for, or sensibility to, contact is one totally and radically distinct from sensibility to the sister impressions producing the sense of pain, or changes of temperature, and that it may be estimated altogether apart; hence the positive necessity in attempting very accurate physiological or pathological investigations, of measuring and limiting the degree of all these kinds of sensibility which may or may not be simultaneously affected.

* Handwörterbuch der Physiologie, Bd. ii., page 568.

Nature, la Distribution, et l'Organe du Sens Tactile," 1837, an interesting pamphlet in which he seeks to establish the nature of the contactile sense and the relative value of the different parts of the skin as an organ of the sense of contact, as also the philosophical and functional anatomy of this organ, has several propositions regarding this discriminative power. Among other things worthy of notice in this work he makes use of a very felicitous expression regarding the discriminative power, and one which if adopted would save much periphrasis. Alluding to the variable distances at which two points touching the skin are perceived to be clearly distinct, and at which they give rise to but a single impression, he applies the terms "limit of distinction" and "limit of confusion" respectively. He shows very clearly that the faculty of perceiving delicate differences of temperature is especially situated in the integument of the face, and that in this respect the skin of the jaws, eyelids and olecranon is much more delicate than the skin of the tongue, lips and extremities of the fingers, which latter parts are however the most highly endowed with contactile discriminative power.

Dr. Graves, of Dublin, also had a paper in the New Philosophical Journal of Edinburgh, in 1836, on the sense of touch, with an analysis of Weber's labours on that subject.

The above brief observations regarding certain facts connected with tactile sensations will suffice I hope to show how interesting the subject, as now considered, is in a physiological aspect; and it might readily have been anticipated that their discovery would ere long be utilized and turned to some practical purpose, which has proved to be the case. Those who may advert to the proceedings of the Société de Biologie at Paris, to our Medico-Chirurgical Review in London, and to the Journal de Physiologie, by Brown-Sèquard, will find that the laws concerning contactile discrimination first evolved by Weber,* and in some points more fully brought out and elaborated by later observers have been applied as methods of detecting and measuring various degrees of contactile anæsthesia or hyperæsthesia in diseased conditions for the purposes of diagnosis or prognosis.

Dr. Brown-Sèquard was the first to make this adaptation. In the first volume of the "Comptes rendus des Séances de la Société de Biologie," page 162, will be seen a communication by

* Landry supposes the diversity shown by different parts of the surface of the body in respect of the contactile sensibility, to be rather a manifestation or expression as it were, of the degree of perfection of the tactile organs than of an inequality in the distribution of the sensibility; being, in fact, an indication of tactile preponderance or intensity, so to say.

him entitled "Recherches sur un moyen de mesurer l'Anæsthésie et l'Hyperæsthésie," wherein he relates the particulars of eleven clinical cases in which by means of a pair of ordinary mathematical two-legged compasses, a deficiency, or an exaltation of contactile discriminative power in the forearm and legs was carefully ascertained and measured. In one case, although the two points in contact with the skin were 10, 15 and 20 centimetres apart, yet the sensation perceived was that of a single point only. In one case of paraplegia the two points applied simultaneously to the feet were distinctly appreciated when only separated to the extent of 5 millimetres (the limit of distinction being here from 20 to 25 millimetres). In this case sensibility to pain was also exaggerated. Again at page 280 of the 41st number (January 1858) of the British and Foreign Medico.-Chirurgical Review is the description of an ingenious instrument called the "æsthesiometer," and contrived by Dr. Sieveking for measuring the nearest distance at which two points made to impinge upon the skin in certain cases of paralysis, give a twofold impression. This is accompanied by one or two cases showing the utility of the instrument,* and by a drawing from which it appears that it is not very dissimilar to the instrument the "Stangenzirkle" used in his physiological researches on the tactile sensations by Weber in the first instance, as alluded to above (page 323).

Similar also in principle to this one of Dr. Sieveking's is another instrument for the same purpose used by Dr. Brown-Sèquard, and described and figured by that physiologist at page 346 of the first volume of his Journal de Physiologie, 1858. This latter instrument differs from that of Dr. Sieveking in having a longer handle, so that, as Brown-Sèquard thinks, greater facility for application and for the *simultaneous* contact of the two points, so absolutely necessary, with the cutaneous surface is permitted.

It occurred to me that several advantages would arise if an instrument could be constructed combining the principle of the beam-compass with that of the so-called mathematical one; and accordingly I had one fabricated which has appeared to me to answer the desired purpose.†

* At page 504 of No. 45 of the same journal Dr. Sieveking gives a striking additional case, exemplifying the use of the instrument; showing the difference in the power of the skin, between the discrimination of painful impressions and that of merely contactile ones.

† It was made for me by the well known firm of Messrs. Elliott and Co., instrument makers, Charing Cross, London, whose foreman Mr. Becker, after learning the principle on which I desired the instrument to be constructed, supplied all the calculations, &c., involved in the delicate graduation of the dial-plate, &c.

Description of the Aphemetric Compass.—The instrument, which is about $4\frac{1}{2}$ inches in length, consists of a pair of mathematical compasses with the usual joint, furnished with a circular dial-plate, whose circumference is divided into inches and tenths and twentieths of an inch, and provided with a central hand or indicator (Fig. 46, 1), which may be moved in any direction, so as to point to the various subdivisions. This dial is attached to the anterior surface of one of the legs of the compass, and the indicator on its face is moved by means of a small wheeled pinion behind the dial, of which the pivot is connected with it through the dial. Into this wheeled pinion (*b*) behind the dial works a segment of a tooth-wheel (*c*), which is attached to the other leg of the compass in such a manner that when the legs are separated, that is when the compass is opened, the tooth-wheel working in the pinion moves the indicator on the face of the dial and makes it point to the various subdivisions.

Fig. 46.

1.

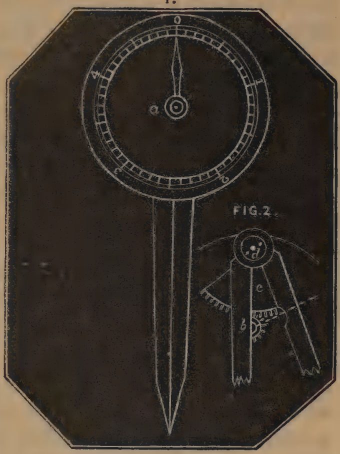


Fig. 46.—1. Shows the front view of the graduated dial-plate, with the indicator.
2. Shows the posterior view, with the tooth-wheel working in the wheeled pinion.

Thus, as these subdivisions are calculated and constructed with reference to the fact that the legs of the compass open round a centre, and not in a straight line, (and consequently are not made equal) the exact distance at which the points of the compass are separated may at once be "read off" on the graduated face of the dial-plate.

In manipulating with this instrument the readiness of measurement, owing to the great length of the graduations on the dial-plate and the quickness with which the corresponding distances* between the separated points of the compass are registered on the dial are at once apparent.

Moreover, the handling of the instrument, owing to the ease with which the two legs can, with one hand, be drawn

* The intervals on the dial-plate between the degrees or various marking lines of division will of course be found, on observation, to be much larger than the space between the points of the compass when opened and separated to a given amount, which each one expresses.

from each other, whilst at the same time the distances between them are simultaneously and clearly indicated (a process which greatly aids rapid observation) is preëminently convenient. Again, its value is enhanced by the fact that it may be used much more freely than the instruments (formed of a straight piece of metal) already spoken of for measuring contactile discriminative power, in the measurement about the joints, or wrists, or feet, where an irregularity or considerable convexity of the surface obtains. I must allow that, as regards its application, the instrument which I had made does not quite possess sufficient range of measuring power, as it is not quite able to measure five inches of the surface; but of course this defect is easily remedied in future instruments of the kind.*

In conclusion, I cannot help saying, that although the application of Professor Weber's physiological discovery to clinical and pathological purposes is most admirable and interesting, yet it has not been found by me to be so very extensively practical as might have been supposed. I have made use of it as a means of diagnosis in very many instances, which I need not now detail, and in numerous cases, owing to the peculiar mental condition attendant upon the cause of the sensory paralysis which was under investigation, I have found that the perceptions and the statements of the patient could not be at all considered trustworthy. The complication of intellectual weakness with the pathological interference as regards sensory and motor paralysis, and the natural obtuseness when in health, and want of habit, in attending precisely to any sensations whatever, or in explaining any sensations of which the mind may be cognisant, met with so often, especially among hospital patients, have not infrequently rendered this mode of diagnosis and prognosis by means of the aphemetrical compass perfectly nugatory. Add to this

* I have given to this instrument the name aphemetric compass, rather than the neater and more euphonious one of æsthesiometer, inasmuch as I was desirous that its designation should be one carrying its own meaning with it as much as possible. The word æsthesiometer would of course apply to an instrument intended to measure the degree of any kind of sensation whatever, whereas the title "*aphemetric compass*" only has reference to the sense of contact, and in a more accurate way than æsthesiometer indicates the use and application of this instrument.

This instrument obtains favour also, I was glad to find, with others than physiologists and physicians. One skilled in mechanics and mathematical appliances spoke in a highly favourable way of its future use for quickly and accurately reducing geometrical distances in the construction of plans, engineering diagrams, &c.; and of its serving, in a superior manner, the purpose of the calipers in ordinary use.

Perhaps, if the limbs of the compass were somewhat arched, this intention of geometrical mensuration would, by making it useful in the case of solid bodies, &c., render it still more generally applicable.

also the extreme necessity for precautionary measures in the use of the instrument, as before stated, and the obstacles likely to arise from the differences normally found as regards contactile sensibility in different people, which moreover may also exist in the same individuals as regards different parts of their skin, and it will be easy to conceive the existence of cases in which anything like an accurate and reliable measurement of this discriminative power becomes futile.

The qualifying observations I am induced to offer, lest others might be inclined to place too high a value upon a comparatively novel application to clinical medicine of a physiological fact which nevertheless undoubtedly possesses great practical importance.

ON THE PRESERVATION OF URINARY DEPOSITS AS PERMANENT MICROSCOPIC OBJECTS.

By Lionel S. Beale, M.B., F.R.S.

Of late years the practical importance, in many cases of disease, of recognising the nature of different substances forming urinary deposits has been strongly felt, and a desire has been generally expressed that a series of the most important might be kept on sale, so that practitioners might have an opportunity of readily obtaining named specimens, with which deposits that from time to time fall under their notice might be compared, and their nature recognised. Persons who prepare and sell microscopic objects have found great difficulty in preserving urinary deposits satisfactorily, and many specimens that have been purchased have been found to lose their characters after a few months, and have soon become quite useless objects. Feeling strongly the real practical value of preparations of this kind, it seems to me very desirable that a few rules with regard to the preservation of urinary deposits should be laid down, and I therefore propose in this communication to describe the different plans which I have found to succeed best. I hope that, shortly, there will be no difficulty in obtaining well-mounted and illustrative series of specimens.* At the same

* Specimens of urinary deposits may be obtained of Messrs. Smith and Beck, Coleman Street, City; Mr. Tennant, 149, Strand; and Mr. Matthews, Surgical Instrument Maker, Carey Street, Lincoln's Inn Fields, who has now in stock several series of excellent preparations.

time any one attending Hospital practice, who has a little time at his disposal, can, without much trouble, prepare such preparations for himself.

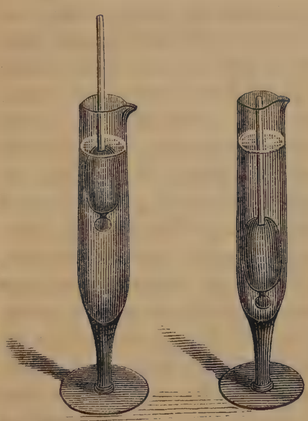
The different characters of urinary deposits render necessary different plans of preservation. It is, therefore, desirable to consider the nature of the deposit before we attempt to preserve it. Some deposits may be preserved *dry*, others may be mounted in *Canada balsam*. A certain number exhibit their characters very well if preserved in *glycerine*, while many can only be kept in certain *aqueous fluids*. For the convenience of description I have divided deposits into three classes :—

1. Light and flocculent deposits.
2. Dense and opaque deposits.
3. Granular and crystalline deposits which occupy a very small bulk

In alluding to the methods of preservation it will be well to adhere to this division.*

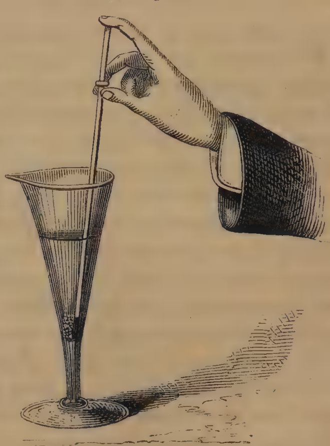
Of separating the deposit from the urine, and of placing it in the preservative fluid.—After the deposit has been allowed to settle in a conical glass the supernatant fluid is to be poured off,

Fig. 47.



Glasses for collecting deposits and for taking the specific gravity of fluids.

Fig. 48.



Conical glass for allowing deposits to subside.

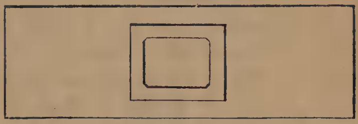
and if it is to be mounted *in fluid* a quantity of the preservative solution, equal in bulk to the urine and deposit that remains,

* The Microscope in its application to Practical Medicine. 2nd Edition page 301.

is to be added. After the deposit has again settled, the fluid is to be poured off and replaced with an equal portion of fresh preservative solution. In this way the deposit is washed clean and properly impregnated with the preservative fluid.

When preparations are to be preserved in a fluid medium, a small shallow water-tight cell is to be used. The specimen and its preservative fluid being placed in the cell, the thin glass is applied and the cover cemented in its place with the aid of Brunswick black or other cement.* In washing urinary deposits prior to mounting them, it is often necessary to add some compound to the water used for this purpose in which they are known to be insoluble, and sometimes it is necessary to add some substance to increase the density of the fluid, for which purpose certain salts, syrup, or glycerine may be employed, according to circumstances. Many deposits, although soluble to some extent in pure water, are quite insoluble in a weak acid, others are insoluble in a weak alkali or in certain saline solutions. Again, it is sometimes desirable to separate certain substances in the deposit from others, and this may be effected by special chemical solutions which have the power of acting on the one and not upon the other; or, in cases where one is more dense than the other, by agitating the deposit with water, and, after allowing time for the heavier one to settle, pouring off the lighter one into another vessel to subside there. From this it may be collected in the usual way.

Fig. 49.



Thin glass cell for mounting thin preparations in fluid.

If the preparation is to be preserved as a *dry object*, water is to be added in the first place, and a portion of the deposit which has thus been carefully washed, is to be removed with the aid of a pipette to the glass slide, and the fluid allowed to evaporate, the whole being covered by a bell-jar over a dish of strong sulphuric acid. When dry it is to be protected from dust by a thin glass cover. The glass cover is easily prevented from pressing upon the preparation by interposing a thin piece of paper or cardboard; or a thin India-rubber ring, which may be easily fixed to the glass slide and thin glass cover, by a little gum made into a thick paste with whiting, may be used.

If the specimen is to be mounted in *Canada balsam* or turpentine, it is to be dried in the manner just described, warmed

* How to work with the Microscope.

slightly, wetted with the balsam, and mounted with the usual precautions.*

The appearance of objects in the microscope depends very much upon the medium in which they are immersed, and many structures are so altered in their character by different media that they would hardly be recognised as the same object. It may be said generally that the darker the object and the more dense its structure, the higher should be the refractive power of the medium in which it is mounted,—thus the dark coloured uric acid, or the thick spherical crystals of carbonate of lime, and the dumb-bells of oxalate of lime, exhibit their structure to the greatest advantage when mounted in the highly refracting *Canada balsam*, or in *strong syrup* or *glycerine*, while the beautifully transparent octohedra oxalate of lime would be scarcely visible in these media, and require to be mounted in an aqueous fluid which possesses a lower degree of refractive power. Many of these objects, when mounted dry, appear quite dark and scarcely exhibit any structure at all, in consequence of great difference in the refracting power of their substance, and the air by which they are surrounded. From these remarks it will be evident how important it is to examine the same object in different media, in fact it is quite impossible to form an idea of the real structure of many specimens without proceeding in this manner.†

Media in which urinary deposits may be preserved.—Urinary deposits may be mounted in *air*, in *turpentine*, *oil*, or *Canada balsam;* in *glycerine*, in *gelatine and glycerine*, in *solution of naphtha and creosote*, in *certain saline solutions*, in *weak spirit*, and in some other aqueous solutions which will be alluded to. The '*glycerine*' alluded to in this paper is *Price's patent glycerine.*

Extraneous matter.—I have dwelt at some length upon the importance of the microscopical observer making himself quite familiar with the appearance of all objects which are likely to fall into the urine accidentally, and I strongly recommend every one to be provided with specimens of these, mounted in an *aqueous fluid*.‡ The naphtha and creosote solution answers best, but a weak solution of glycerine may be employed. The tendency of glycerine, by its high refractive power, to render substances immersed in it unusually transparent, must be care-

* How to work with the Microscope.

† On this subject the reader is referred to "How to work with the Microscope," p. 59, and "The Microscopic in its application to Practical Medicine," 2nd Edition, §§ 74, 89, 90.

‡ Microscopical Journal, No. II, p. 93.

fully borne in mind. Objects put up in this preservative solution would present a very different appearance if they had been immersed in the urine, and on these grounds it is objectionable. The naphtha and creosote solution is perfectly transparent, and is not liable to this objection.*

The extraneous matters, with the characters of which every physician who uses the microscope should be familiar, are the following :—

Human hair.	Feathers.	Wheat starch.
Blanket hair.	Tea leaves.	Testa of wheat.
Cat's hair.	Fibres of deal from the floor.	Cells of potato in which the starch is lodged.
Flax fibres.	Potato starch.	Air bubbles.
Breadcrumbs.	Rice starch.	Oil globules.
Cotton fibres.		

The microscopical characters of these are figured in the "Illustrations of Urine, Urinary Deposits, and Calculi," Plates I. II. and III, figs. 1 to 16.

Of keeping a quantity of the urinary deposit for subsequent inquiries.—In cases where it is desirable to retain a certain quantity of the deposit in the preservative solution for subsequent examination, or for the purpose of making more preparations, it should be kept in a small glass tube with a tight-fitting cork, and carefully labelled. Most urinary deposits may be kept for a longer time in this manner, than mounted in thin cells. I propose now to describe briefly the various plans adapted for the preservation of urinary deposits that have been found to succeed best.

* The composition of this fluid is as follows:

Solution of Naphtha and Creosote.

Creosote	3 drachms.
Wood naphtha	6 ounces.
Distilled water	64 ounces.
Chalk, as much as may be necessary.	

Mix first the naphtha and creosote, then add as much prepared chalk as may be sufficient to form a smooth thick paste; afterwards add, very gradually, a small quantity of the water, which must be well mixed with the other ingredients in a mortar. Add two or three small lumps of camphor, and allow the mixture to stand in a lightly-covered vessel for a fortnight or three weeks, with occasional stirring. The almost clear supernatant fluid may then be poured off and filtered if necessary. It should be kept in well-corked or stoppered bottles.

I have some large preparations which have been preserved in upwards of a pint of this fluid, for more than seven years, and the fluid is now perfectly clear and colourless. Some dissections of the nervous systems of insects have kept excellently; the nerves retain their white appearance, and have not become at all brittle. Two or three morbid specimens are also in an excellent state of preservation, the colour being to a great extent preserved, and the soft character of the texture remaining. I have one preparation mounted in a large gutta percha cell, containing nearly a gallon of this fluid.

First Class of Urinary Deposits.

Mucus.—It is very difficult to preserve the character of the so-called "mucus corpuscles," or imperfectly formed epithelial cells, nuclei, and granules, which constitute the slight flocculent deposit met with in healthy urine, and termed "mucus." The naphtha and creosote solution is best adapted for the purpose, and it is desirable to place the specimen in a cell about the twentieth of an inch in depth.

Epithelium.—The different varieties of epithelium are easily preserved, although, after the lapse of some time, minute oil globules make their appearance in them. They may be kept in naphtha and creosote fluid, to which one-fourth of its bulk of glycerine has been added. It is well to put up specimens of epithelium from the urethra, bladder, ureter, and pelvis of the kidney, removed from the organs of a healthy man who has been killed accidentally. They should be mounted in very thin cells. Specimens of the epithelium from the vagina, which can generally be obtained from the urine of females, should also be preserved.

Vegetable Growths—Fungi.—I have found that fungi may be preserved most satisfactorily in glycerine, for although they appear somewhat more transparent in this fluid than in urine, they preserve their general character better than when immersed in other preservative fluids. It is necessary to add weak glycerine in the first instance, and to increase the strength gradually, otherwise the fungi become collapsed, owing to the great density of the strong solution. A solution composed of equal parts of water and Price's glycerine is sufficiently strong to preserve fungi. I have not been able to preserve specimens of sarcinæ which I have met with on two or three occasions in the urine, probably in consequence of their extreme delicacy. The sarcinæ which are from time to time met with in vomit keep perfectly well, and preserve their recent characters in glycerine.

Spermatozoa are sometimes mounted in the dry way, but although their general form is preserved, their refractive power and transparent appearance are so different from what is observed when they are immersed in urine, that little is gained from such preparations. Spermatozoa keep very well in glycerine, although they appear rather more faint than in an aqueous fluid. They should be examined with the *eighth of an inch object-glass* (× about 400), but when the eye of the observer has become familiar with the general appearances, they may be

readily recognised with a quarter of an inch object-glass (× about 200).

Casts.—It is not difficult to preserve the character of some varieties of casts. The transparent casts often become covered with numerous minute granules and oil globules, and their character much altered. Granular casts and epithelial casts often keep very well in the naphtha and creosote solution, but altogether I prefer glycerine, with one-third part of water. Although in many instances the cells they contain are altered, and oil globules appear much more transparent than when in urine, this alteration in character may be easily allowed for. I have some specimens of large waxy casts and epithelial casts which have been kept in the naphtha and creosote solution for upwards of seven years, and still preserve their characters well. The specimens in glycerine, of course, keep admirably. Some casts may also be preserved in gelatine and glycerine, care being taken that the mixture is not made too hot.

Second Class of Urinary Deposits.

Pus.—Recent specimens of pus may be so readily obtained that it is hardly necessary to attempt to preserve the corpuscles permanently. Their characters alter so much in all the preservative fluids that I have tried, that after they have been put up for some time it would be difficult to recognise the nature of the preparation.*

Phosphates.—The phosphate of lime, in its amorphous form, in globules, and minute dumb-bells, is easily preserved in weak spirit, naphtha and creosote fluid, or glycerine, but the character of the crystals of the triple, or ammoniaco-magnesian phosphate, could not be retained in this solution. As is well known, this salt is quite insoluble in solutions of ammoniacal salts, and these make the best preservative solutions for it. Crystals of triple phosphate may be kept for any length of time, with their smooth surfaces and their lustre unimpaired, in distilled water, to which a little chloride of ammonium has been added. Phosphate of lime and the stellar form of triple phosphate may be dried carefully, and mounted in Canada balsam, but, of course, the appearance of the crystals is a good deal altered.

Urates.—As the urates are so commonly met with, and as they are generally deposited in the form of granules, there is scarcely

* Dr. Andrew Clarke speaks highly of some fluids which he has prepared, containing bichloride of mercury and arsenious acid.—"The Microscope in its application to Practical Medicine." 2nd Edition p. 237, note.

any need of mounting them as permanent objects. If desired, however, deposits of this kind may be preserved by adding a little naphtha and creosote fluid to the deposit which should be left in it for a considerable time before it is put up. Urates which crystallize in small spherical masses, as often occur in the urine of children, and more rarely in irregularly branched processes, may be preserved very well in Canada balsam, or if preferred, they may be kept in the naphtha and creosote fluid.

Third Class of Urinary Deposits.

Blood Corpuscles become more or less altered in most preservative fluids. I think that those which I have mounted in glycerine (one part glycerine to two parts of water) have undergone the least change.

Uric Acid crystals are easily preserved as permanent objects. The usual plan is to mount them in Canada balsam. They should be washed, in the first instance, with a little water to which a few drops of acetic acid have been added. When pretty clean, they may be placed upon a glass slide, with the aid of a pipette, and the greater quantity of the fluid absorbed with a small piece of bibulous paper. After the crystals have been properly arranged on the slide with a needle, they may be dried, by exposure under a bell jar over a dish containing sulphuric acid. When quite dry, they may be moistened with a drop of turpentine and mounted in Canada balsam. In this operation a very slight excess of heat should be employed, otherwise the crystals will become cracked in all directions, and more or less opaque. Uric acid crystals, as a general rule, do not keep well in glycerine. In cases where we wish to preserve other substances in the deposit as well as uric acid crystals, the naphtha and creosote fluid will be found to answer very well. I have some preparations mounted in this manner which were put up six or seven years ago.

Cystine.—Crystals of cystine may be preserved in Canada balsam, the same care being taken in mounting them as mentioned under uric acid, or they may be kept very well in distilled water, or in the naphtha and creosote fluid, to which a little acetic acid has been added.

Oxalate of Lime.—Both the octohedra and dumb-bells may be preserved in glycerine, but the former look very transparent in that fluid. The dumb-bells may also be mounted in Canada balsam, but in this medium the octohedra are almost invisible. When required for polarizing they should be put up in balsam. The dumb-bells keep very well in glycerine.

On Preserving Crystalline Compounds obtained from Urine.

It is exceedingly difficult to preserve many of the crystalline substances obtained from urine in a moist state, but several of them form beautiful microscopic objects when carefully dried—*Urea*, *nitrate of urea*, *oxalate of urea*, *creatine*, *creatinine*, *alloxan*, *hippuric acid*, *murexid*, and many others may be kept as permanent objects in this manner. In order to prepare them, it is better to cause them to crystallize upon a glass slide; allow the mother liquor to drain of, and immdiately place the slide under a bell-jar over sulphuric acid. Sometimes the crystals may be made in a small evaporating basin, and when drained and dried, a portion of them may be removed to a glass cell and covered with a piece of thin glass to exclude the dust. Many crystals may be examined and preserved for a considerable time in their own mother liquor, especially when they are very slightly soluble in fliud, but as a general rule this plan does not answer very satisfactorily, for, independently of the escape of the fluid from the edges of the cell, a few of the largest crystals grow still larger at the expense of the smaller ones, and the beauty of the specimen is destroyed. The different forms of these crystals, as they appear in the microscope, are given in the "Illustrations of Urine, Urinary Deposits, and Calculi." Urine, plates I to IX. See also "The Microscope in its application to practical medicine," chapter ix., page 292.

ON THE USE OF VULCANITE INDIA RUBBER FOR MAKING CELLS.

"I HAVE lately been strongly impressed with the great value of Vulcanite India Rubber, for making cells, of any size or depth, for mounting objects in fluid. It may be obtained in sheets, and the centre turned out in a lathe, just as easily as if it were a piece of ebony. It is extremely hard, takes a beautiful polish, and is not acted upon by any of the solutions ordinarily used for the preservation of animal or vegetable tissues. An intense heat is requisite to make any impression on it, so that the cells may be fastened to the glass

slide with marine glue. You will find no difficulty in procuring it in town; for it is, I believe, now much used for brush-handles and other purposes, instead of ebony, which it closely resembles in appearance. Any turner can make some dozen cells in an hour, and being so much cheaper than glass, especially when very large cells are required, I have no doubt that, when known, it will be extensively employed by all microscopists. I send you one that you may judge for yourself. The Vulcanite India Rubber is sold by Goodyear and Son, No. 47, Leicester-square, and can be obtained in sheets of any thickness."—Extract from a letter from the Rev. G. S. B. Isbell, Bath.

COMPRESSORIUM FOR PRESSING DOWN THE THIN GLASS COVER WHILE CEMENTS OR CANADA BALSAM ARE DRYING.

By the Rev. G. S. B. Isbell, Bath.

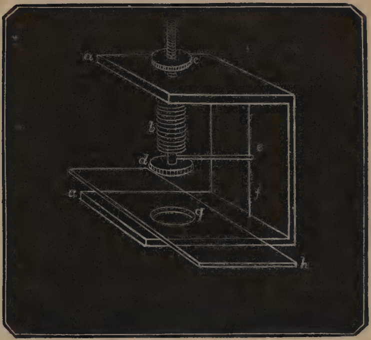
THIS little apparatus is intended to press down the glass cover of microscopic objects while the cement or balsam is hardening, so as to keep the objects in their place, and to prevent them from curling up, which often causes much difficulty in preserving them. This I have found not unfrequently to occur in mounting sections of horny and other tissues, which should present a perfectly flat surface for examination. The frame of the Compressorium is made of brass, bent at right angles, to form an open square, or it may be in the form of the letter C, only having the lower part flattened, to give it a firm base. It should be not less than an inch and a half in depth and breadth, to admit cells of a large size.

Through the upper arm passes a screw, about one-eighth of an inch in diameter, with a tolerably strong and elastic spiral wire-spring surrounding it. A disc of cork is cemented to one end to press on the covering glass, and a nut works on the other end above the arm, by means of which the disc can be raised or depressed. A circular aperture is made in the lower arm or base, so that the object which is placed upon it may be examined if required. It is desirable to have a narrow piece of brass, soldered to the screw, just above the disc, with a hole in it, through which passes a wire attached to the upper and

lower arm, to keep the disc from turning round in its ascent and descent. This, however, is not absolutely necessary, as it can be held between the finger and the thumb until it is sufficiently pressed on the covering glass of the object properly arranged over the circular aperture.

The following sketch will make this description more intelligible.

Fig. 50.



a The brass frame.
b The screw and spiral spring.
c The nut to elevate and depress the cork disc, and to regulate the amount of pressure.
d The disc.
e The brass bar through which passes the wire (*f*) to steady the disc.
g The circular aperture.
h The slide carrying the object, properly arranged over the aperture

I gave the design of this Compressorium to Mr. Heath, Optician, Fore-street, Devonport, who made one for me, and has, I find, constructed some for sale, to hold several slides.

REPORTS OF RESEARCHES PUBLISHED ELSEWHERE.

CONTRIBUTIONS TO THE PATHOLOGY OF ICTERUS.

By Dr. W. Kühne.

From "Virchow's Archiv," 3rd and 4th Part of 14th Vol. September, 1858.

(Abstract by George Scott, M.D.)

ICTERUS, a term comprehending a group of diseases characterized by yellow colour of the skin and some of the secretions, is, in the majority of cases, caused by obstruction of the flow of bile into the intestine. For a long time past, it has been held that no change occurs in the activity of the liver under these circumstances, and that the bile continues always to be secreted, being afterwards partly deposited in the skin, and partly excreted by the urine. This idea was confirmed by the absence of the colouring matter of the bile in the fæces, and the presence of the same in the skin and urine. After, however, the bile began to be examined chemically, and it was discovered that the colouring-matter, as regards weight, was its most unimportant constituent, and that the greater part of this secretion consisted of other substances before described as bile-resins, the urine was submitted to chemical analysis instead of to mere observation.

Thénard and Orfila were the first who thought that they detected the resinous constituents of the bile in icteric urine. It was not, however, until Strecker discovered that the bile was a solution of alkaline salts of two coupled acids that the science of chemistry was far enough advanced to afford any certain results in the investigation of the pathology of icterus. These bile-acids form, with their combinations and derivatives, a chain of substances so well characterized, that the secretion of the liver can be easily detected, even under pathological conditions. Pettinkoffer's test has given to the chemist a means of detecting with certainty, quantities of bile-acids too small for elementary analysis.

Notwithstanding that the detection of bile-acids was no longer difficult, yet, curiously enough, there is scarcely a

subject upon which chemists and physiologists have been more at variance than upon the question of the presence or absence of bile-acids in the urine.

Lehmann considers that the existence of bile-acids in the urine is an extremely rare occurrence, and that it is just the deeply coloured urine of icteric people which contains no bile-acids.

Gorup-Besanez and Scherer have come to the same conclusion. Frerichs and Staedeler aver that bile-colouring matter and bile-acids *never* appear together in the urine; that, on the other hand, sometimes traces of the biliary acids can be detected in urine having no jaundiced hue; hence they conclude that there is some connection in the origin of these two substances. The following experiment seemed to confirm this:—Frerichs injected into the veins of a dog ox-bile completely freed from mucus and colouring-matter. The animal's urine afterwards secreted was extraordinarily deeply coloured, and chemical analysis showed that in reality bile-colouring-matter was present in the urine as a sediment. Substances giving the Pettinkoffer reaction were not detected. Hence Frerichs concluded that so soon as bile-acids arrived in the blood, they were changed into bile-colouring-matter. This hypothesis seemed to be confirmed by the artificial formation of bile-colouring-matter out of glycocholate and taurocholate of soda.* If, in fact, one of these salts be digested for a long time, at an ordinary temperature, with concentrated sulphuric acid, the solution assumes gradually several different colours, and, after a certain time, on the addition of water, a flaky precipitate can be produced similar, in many respects, to bile-colouring-matter. Frerichs has confirmed the correctness of the above experiments by frequent repetitions.

Kühne, however, does not agree with Frerichs that the bile-acids are changed into bile-colouring-matter in the blood, for if so, after injecting 3·5 grammes of bile-acid salts into the blood, the urine afterwards secreted would not have the usual icteric colour, but would be perfectly black; and, in a jaundiced person, when bile-acids do not pass off by the normal routes, the colour of the skin would become perfectly black in a short time. This theory of Frerichs has, however, not been called in question, because bile-acids have not hitherto been demonstrated as an integral part of icteric urine. Kühne attributes this latter circumstance to the insufficiency of the tests which have been, up to the present time, employed for the purpose.

* *Glycocholic* and *cholic* acids are synonymous; also, *taurocholic* and *choleic* acids.

Dr. Felix Hoppe has communicated, in the thirteenth volume of "Virchow's Archiv," a new method of detecting with great certainty any quantity of bile-acids in the urine. This method is as follows:—

Decompose the icteric urine to be examined with an excess of milk of lime, and then boil for about half an hour; filter; evaporate the filtered fluid nearly to dryness; decompose with a great excess of concentrated hydrochloric acid, and then keep the whole, before being filtered, at the boiling point for half an hour. To avoid spurting of the fluid, it is necessary to renew the volatilized hydrochloric acid from time to time. Leave the liquid to get completely cold, and then add six to eight times its volume of water. Filter the dark brown turbid solution thus obtained, wash out with water the residue on the filter until the same runs through quite colourless; dissolve the brown resinous mass on the filter in 90 per cent. alcohol; decolorize by boiling with animal charcoal, filter, and evaporate to dryness in the water-bath; the residue is a yellow, resinous mass, which, if bile-acids be present, must consist for the most part, of pure choloidic acid. In such a case it melts by warming and emits the peculiar musk or soap-odour. Lastly, dissolve in a very little caustic soda and some drops of warm water, add a very small piece of sugar, and allow three drops of concentrated SO_3 slowly to fall into it. At first the fluid becomes milky and troubled, and resinous flakes separate which stick pertinaciously to the glass, but afterwards, by the addition of more SO_3, these again dissolve and produce a beautiful purple-red or dark violet fluid.

In icterus caused by closure of the ductus communis choledochus, the urine contains always bile-acids as well as bile-colouring matter.

Kühne examined five litres of *normal* urine for bile-acids, after Hoppe's method, but did not detect any; he, therefore, concludes that the presence of *bile-acids* is a peculiarity of only icteric urine.

Kühne found in one case that, when carbonate of soda, and at the same time glycocholate of soda, were injected into the veins of a dog, the urine contained, besides the hippurate of soda, *carbonic-acid* salts. This urine gave directly no Pettenkoffer's reaction with sugar and SO_3, and, as it was not examined for bile-acids by Hoppe's method, Kühne supposed that the cholalate of soda formed in the body during the course of this experiment may have been changed, by oxydation, into carbonate of soda. On frequent repetition of the experiment, however, the carbonic acid salts were as often absent as present in the urine,

and when the latter was examined for bile-acids by Hoppe's method, cholalic-acid was *invariably* found undecomposed in that fluid. Hence the assumption that the carbonic acid salts which sometimes appeared in the urine in these cases, were formed by the oxydation of the cholalic acid salts, is not tenable, and Kühne is quite unable to account for their casual occurrence.

Some experiments were then made upon the use of benzoic acid during icterus, and it was found that in this disease, after the use of benzoic acid, or its alkaline salts, *no hippuric acid,* but *unchanged benzoic acid* was excreted with the urine. Without doubt this seems to indicate some modification in the function of the liver coming on so soon as the bile cannot find its way without impediment into the intestine. As is known, the mere presence of glycin, either free or as a constituent of glycocholic acid, in the blood, is sufficient to change the benzoic acid arriving in that fluid into hippuric acid. As we have seen that in icterus benzoic acid, when swallowed, is not changed into hippuric acid, but re-appears uncombined in the urine; it follows, that most probably in jaundice that no glycocholic acid, but taurocholic acid, or perhaps only cholalic acid, is formed in the liver. Kühne examined the urine of an icteric patient, in the wards of Professor Virchow, for glycin and taurin, but found neither; whereas, if glycocholic acid had continued to be formed in the liver, had been absorbed into the blood and aftewards excreted by the urine, of course glycin ought to have been detected in the latter fluid. It must, however, be remarked that the process employed for the detection of glycin and taurin was not such a good one as to demonstrate with certainty the absence of these substances.

Kühne's next series of experiments proved that the soda salts of glycocholic, cholalic, and choloidic acids, after being injected into the veins, again leave the bodies of the animals unchanged through the kidneys.

It is worthy of remark that the dogs thus operated on very often died suddenly immediately after the injection of the bile-acid salts, without it being ever possible to prove the entrance of air into the veins, at the post-mortem examination of the body made directly after death. This circumstance has been observed by other experimenters. It is possible that the injection of bile-acid salts into the blood may be the cause of great disturbance in the system. In one of the experiments, ten minutes after the injection of 15 cub. centim. of a 6 per cent. solution of glycocholate of soda into the right jugular vein, spasms resembling completely an epileptic fit came on, and lasted half an hour. Kühne has not been able to obtain the same result

again, although he has often tried. But he has observed that in most cases, in a longer or shorter time after the injection, a condition arose characterized in the same way in all the animals by somnolence and diminished appetite. None of these conditions had, however, any influence upon the composition of the urine.

Thus Kühne's results contradict completely those of Frerichs, who asserts that after the injection into the blood of glycocholate of soda, or any other pure bile-acid salt, bile-colouring-matter appears in the urine, while unchanged bile-acids are never to be found.

In most of Kühne's cases experimented on as above described, there was a small quantity of albumen in the urine. In two cases there was hœmaturia. Dusel was the first who observed hœmaturia after the injection of bile-substances into the blood in rabbits. Frerichs observed hœmaturia seventeen times out of twenty-nine injections. Kühne does not know the exact conditions under which hœmaturia supervenes—why it comes on in some cases and not in others.

Frerichs and Staedeler were, as is well known, the first to observe the appearance of bile-colouring-matter in the urine after the injection of colourless bile-substances, a fact which is confirmed by Kühne's experiments, as well for the glycocholate as for the cholalate and choloidate of soda. The quantity of the excreted bile-colouring-matter appears, however, to be subject to considerable fluctuation, and it is this circumstance which has caused Frerichs to assert that the bile-colouring-matter in such experiments may be entirely wanting in the urine. It sometimes, indeed, happened to Kühne that, after the above experiments, the urine had no icteric appearance at all, and by mixing it with nitric acid, showed no characteristic change of colour, but, by a more careful examination, it was possible to demonstrate the presence of bile-colouring-matter by the nitric acid test.

In such cases, the mode of proceeding particularly to be recommended is to pour into a test-tube a layer of nitric acid about one inch high, and then, by means of a pipette, to allow the urine to run down the walls of the glass so slowly and carefully that it can scarcely mix with the acid. Then, if bile-colouring-matter be present at the point of contact of both fluids, the characteristic colours are seen as beautiful rings;—in this way this test obtains such an extraordinary degree of exactitude, that one can even detect the bile-colouring-matter in bile so much diluted with water, that the fluid in a layer 4 cub. centim. thick appears only slightly coloured. Of course,

the nitric acid ought to contain only very little nitrous acid, as an excess of the last again destroys the colours. Kühne used quite pure, colourless, nitric acid. If one proceed in the above way with *normal* urine, one sees arise between the latter and the acid, for the most part, an intense red, sharply-defined ring, which, however, cannot be mistaken for the proper bile-colouring-matter reaction, as the latter is easily distinguished by the supervention of violet and green rings.

How can this invariable appearance of bile-colouring-matter in the urine after the injection of colourless bile-acids into the blood be explained? This question and the hœmaturia coming on in these cases admit of easy solution by the fact discovered by Hühnefeld, Plattner, and Simon, viz., that the bile-acids and their salts have the peculiar property of dissolving the blood-corpuscles. The blood-corpuscles of mammalia and birds are easily dissolved by bile and bile-acids, but those of the frog are not so. On the other hand, the liver cells of mammalia and birds are *not* dissolved by bile and bile-acids, but those of the frog *are*, at least in the spring, viz., in February, March, and April.

Kühne, therefore, attributes the appearance of bile-colouring-matter in the urine after the injection of colourless bile-acids into the blood, to the hematin set free by the solution of a certain number of the blood corpuscles.

Unfortunately, it has not yet been possible to form out of the body, bile-colouring-matter from the colouring-matter of the blood.

What the chemist has not yet succeeded in doing, namely, in separating hematin from bile-colouring-matter, we see easily accomplished in the living animal. If a bile-acid-salt be injected into a vein, soon afterwards free blood-colouring-matter and bile-colouring-matter appear in the blood. In most cases, the greater quantity of the bile-colouring-matter goes over alone into the urine, and only sometimes the blood-colouring-matter follows it. But in the latter case it is easy to recognise each substance by itself, as was seen in those experiments where hæmaturia came on.

Kühne then made some experiments by injecting free hemato-globulin into the veins of dogs. The hemato-globulin used for this purpose was prepared in the following way :—The dog experimented on was bled 24 hours before to 20-50 grammes, according to the weight of his body—the venesection was generally performed in the afternoon; then by the next morning, the coagulum and serum had so far separated from each other, that the former could be taken out, and, by careful washing, could be almost entirely freed from serum. The pure coagulum

containing all the blood-corpuscles was then mixed with 5-6 times its volume of distilled water, and sucked into a syringe with a wide opening, by drawing up the piston, which could be easily done completely after several pulls. Thus, by repeating this, first with the largest and lastly with the finest canula placed on the syringe, it was very easy to break up the cake of 50 grammes of blood, within five minutes, to such an extent, that the fibrine appeared suspended in the fluid only as a fine, flaky cloud. After this latter had, for the most part, sunk to the bottom, the fluid was then carefully poured off and filtered. The filtered fluid contained now scarcely any uninjured blood-corpuscles; so that in this way was obtained a tolerably concentrated solution of hemato-globulin, the preparation of which required so little time, that a venesection and an injection could always be made in the same dog within 24 hours.

If now, Kühne injected into the jugular or crural vein of healthy dogs 15 cub. centim. of such a solution of hemato-globulin, heated previously to 32° C., which could easily be done without the least hurt to the dog, generally on the next morning, a tolerably dark-coloured, alkaline, albuminous urine was passed, which showed a reaction, with nitric acid, resembling that of bile-colouring-matter, but not proving unequivocally the presence of the latter. When the albumen was removed by heat and acetic acid, and the fluid tested for bile-colouring-matter, the result was negative. But it is possible that a small quantity of the bile-colouring-matter may have remained sticking to the albumen when the latter coagulated. Therefore, it is not right to reject altogether the supposition that bile-colouring-matter may arise out of free hemato-globulin contained in the serum under otherwise quite normal conditions. But the following experiments prove that the *presence of bile-acids in the blood* is not without great influence in the formation of bile-colouring-matter out of the hemato-globulin: A dog that had before only been subjected to an injection of hemato-globulin, had now 15 cub. centim. of such a solution, with the addition of only 0·5 cub. centim. of a 4 per cent. solution of glycocholate of soda injected into the left jugular vein. *The urine of the dog next day* contained albumen, and *gave a splendid reaction of bile-colouring-matter with nitric acid.* This experiment was repeated twice with the same result. When the same quantity 0·5 cub. centim. of glycocholate of soda was injected alone into the veins, without the solution of hemato-globulin, the urine of the dog afterwards contained but a trace of bile-colouring-matter. It must be remarked that, as it would not be possible to inject so small a quantity as 0·5 cub.

centim. of glycocholate of soda solution by itself, it was mixed with 15 cub. centim. of defibrinated blood of the same dog, and then injected.

Hence, Kühne concluded that blood-colouring-matter, is converted into bile-colouring-matter, when the former is subjected to the yet unexplained influence of the bile-acids.

There are two things here to be distinguished. 1. That the injection of large quantities of bile-acid-salts into the blood deprives a large number of the blood-corpuscles of their membranes, and hence brings free hemato-globulin into the blood-plasma. 2. Hereupon the injected-material works in an unknown manner upon the blood-colouring-matter set free, without, however, undergoing any change itself, as its passage over into the urine unchanged shows.

Kühne considers that the fact of the solution of the blood-corpuscles in the living body by bile-acid-salts, and the formation of bile-colouring-matter out of blood-colouring-matter, gives support to the theory that a not inconsiderable amount of blood-corpuscles is destroyed in the liver, and that the colouring-matter found in the bile represents the changed product of the hematin which had been contained in this portion of the blood-corpuscles dissolved. And, with this idea, it is interesting that further experiments of Kühne's have proved that there is no difference in the solubility of the corpuscles of the blood in any of the veins or arteries of the body.

Kühne then subjected to analysis the *healthy* fœces and urine of dogs, before proceeding to the chemistry of the liver-secretion in icterus artificially produced. He found that cholalic acid, choloidic acid, and dyslysin existed *normally* in the dog's fœces, and in such large quantity that he concludes that almost none of the bile-acids are re-absorbed from the intestine, but that they pass off, for the most part, in the excrements. This idea is strengthened by the fact shown above, that bile-acids pass unchanged from the blood into the urine; and, that, therefore, there would be no reason why *healthy* urine should not contain bile-acids, if the latter were absorbed normally into the blood; but, as we have seen, *healthy* urine contains no bile-acids. Bidder and Schmidt were the first who asserted that the constituents of the bile were, in a great measure, re-absorbed from the intestine, because they found that the sulphur-smell of the fœces did not represent, by any means, that of the bile secreted in a corresponding time. But it by no means follows that bile-acids are re-absorbed from the intestine, because the sulphur belongs alone to the taurin; and it is quite possible that the glycocholic and tauro-

cholic acids, after their undoubted division, only give up the glycin and taurin as easily soluble bodies to the general circulation. It is difficult also to conceive how such a slightly soluble salt as the cholalate of soda can be absorbed, more especially as the presence of choloidic acid and dyslysin in the fœces shows that the bile-acids must have remained a long time in the intestine.

As regards the *normal urine* of dogs, Kühne never detected, even in 5 litres of the same, bile-acids, by means of Hoppe's method. Neither could, in the same quantity of urine, traces of benzoic acid be found according to Liebig's or Lehmann's method.

Kühne found that in animals with biliary fistula, where there was some obstruction to the excretion of bile by the fistula, bile-colouring-matter may appear in the urine *without* bile-acids.

Kühne tied the ductus communis choledochus of a dog, so as to prevent any excretion of bile, and found that its blood, twenty-four hours after the application of the ligature, already contained bile-acids.

The method employed for detecting bile-acids in the blood was as follows: the whole blood was dried in a water-bath by a gentle-heat, afterwards in an air-pump, then the dried mass was thoroughly pulverised. The latter was now extracted with a great excess of absolute alcohol; the alcohol filtered, evaporated, the residue dissolved in water, and the watery solution, by boiling with a drop of acetic acid, and filtering it from the coagulum which thereby formed, freed completely from every trace of the albuminate of soda. Then it was again evaporated, the residue again dissolved in alcohol, the latter expelled by heat, very little water added and filtered. In the filtered fluid which, therefore could contain neither fats nor albuminates, sugar and sulphuric acid should produce, when bile-acids were present in the blood, the most beautiful violet colour.

The above dog was operated on on the 26th April, 1858, and the urine soon afterwards became of a deep jaundiced hue; on the 7th May, however, the appearance of this fluid changed in a remarkable way—the quantity of bile-colouring-matter contained in it began visibly to diminish until, at last, the urine assumed quite a pale-yellow appearance. However, there was always a trace of bile-colouring-matter to be detected by nitric acid, and the quantity of bile-acids continued almost the same throughout. When the quantity of bile-colouring-matter in the urine was reduced to a minimum, Kühne injected 15 cub. centim. of a solution of hemato-globulin prepared in the way

above described, into the right jugular vein. The result was the appearance of a *considerable amount* of *bile-colouring-matter* besides albumen and bile-acids in the urine of next morning.

The day following, however, the amount of bile-colouring-matter in the urine was again very small. Two other injections of hemato-globulin were made with the same result.

It was most remarkable that during the whole time of the ductus communis choledochus being impervious, the dog had not an icteric appearance. The conjunctivæ remained uncoloured as well as the rest of the body, and only the urine showed, by the presence of bile-colouring-matter and bile-acids, the true icteric condition. But here in the urine we saw the bile-colouring-matter at last almost entirely disappear, while the cholalic acid was always in undiminished quantity excreted from the body. Unfortunately, the ductus communis choledochus became again pervious, as was evidenced by the sudden excretion of strongly-coloured fœces, and the contemporaneous disappearance of the bile-acids from the urine. This happened on the 18th May, twenty-two days after the operation.

Kühne repeated the above experiment on another dog with exactly the same results. This second dog died eight days after the operation.

In icteric urine the small quantity of hippuric acid contained in *normal* urine, is absent. This circumstance is interesting as showing that the origin of hippuric acid, which is independent of the introduction of the benzoyle-compounds into the blood, appears to be in the liver.

Kühne thinks it advisable, in the examination of icteric urine, that attention should be chiefly directed to the detection of *cholalic acid*, when bile-acids in general are sought for. The shortest method of detecting cholalic acid in the urine is the following:—

Evaporate the urine as far as possible; if the residue re-act neutral or alkaline, acidulate it slightly with hydrochloric acid, and then triturate with pure quartz-sand. Shake up the solid residue sticking to the sand-grains in a closed bottle, moisten with very little alcohol, and then extract completely with ether. After twenty-four hours, pour off the ether, evaporate the latter, treat the remaining brown resinous mass which, besides some urea, contains the cholalic acid, with boiling water, and then filter boiling hot. The filtered fluid precipitates, after some minutes, resinous flakes on the walls of the glass, from which the fluid can be easily poured off. If the flakes be now poured over with some sugar-water, and sulphuric acid be added

carefully, very soon the characteristic violet colour can be observed.

The result of Dr. Kühne's observations may be briefly summed-up under the following heads:—

1. In icterus caused by closure of the ductus communis choledochus, the urine contains *always* bile-acids and bile-colouring-matter.

2. The presence of bile-acids in the urine is a peculiarity of icteric urine only.

3. In jaundice, when benzoic acid or its alkaline salts are taken into the stomach, they re-appear unchanged in the urine.

4. It, therefore, follows that no glycocholic acid is formed in the liver during jaundice, but taurocholic acid or perhaps only cholalic acid.

5. Bile-acids are not decomposed in the blood. In whatever manner they find their way into that fluid, they are afterwards excreted by the kidneys. Glycocholate of soda passes out from the blood unchanged into the urine. When the cholalate and the choloidate of soda arrive in the blood, there are found in the urine soon afterwards substances which give the Pettenkoffer reaction.

6. After the injection into the veins of colourless solutions of bile-acids or their salts, bile-colouring-matter appears in the urine.

7. The appearance of bile-colouring-matter in the urine after the injection into the veins of colourless bile-acids or their salts, is explained by the fact of the latter having the property of dissolving the blood-corpuscles, and thus setting free a quantity of hematin, which being acted on, in some yet unexplained way, by the bile-acids or their salts, is converted into bile-colouring-matter.

8. It is probable that a considerable number of blood-corpuscles is destroyed in the liver, and that the bile-colouring-matter is derived from the hematin set free by the solution of these corpuscles.

9. The bile-acids, for the most part, pass off by the fœces, and are *not* re-absorbed from the intestine.

ON THE PATHOLOGICAL PRODUCTS IN THE LIVER AND KIDNEYS IN LEUKÆMIA.

By Arthur Boettcher.

From "Virchow's Archiv.," 5th and 6th Part of 14th Vol., Nov. 1858.

(Abstract by George Scott, M.D.)

After Virchow had thoroughly established, that the origin of leukæmia could always be referred to an affection of the spleen, or of the lymphatic glands, accompanied often by disease of the liver, he called attention to the supervention in this malady, of pathological formations in the liver and kidneys, resembling lymphatic elements. This induced him to admit, along with the lymphatic dyscrasia, a kind of lymphatic diathesis, a progressive disposition on the part of the organs to produce lymphatic elements, an observation of great interest in connexion with the history of the scrofulous and tubercular processes.

Since then Friedreich has related a very interesting case, in which leukæmic tumours were found in the pleura and in the intestinal canal, the origin of which he could refer to the corpuscles of the connective tissue.

Of a similar kind is the case related below, where besides new products in the small intestine, similar ones were found in the liver and kidneys, the origin and relation to the original tissue of which could be accurately observed.

The patient was a man aged 40, who died in the Dorpat Hospital in May, 1858, at the post-mortem examination, the leukæmic nature of the process was sufficiently established, by microscopical examination of the blood.

The mesenteric glands were greatly enlarged, some being of the size of a hen's egg, the axillary and inguinal glands, and those of the neck were also much hypertrophied. The *liver* was large, weighing 7 lbs., and reaching pretty far towards the left side. It was granular on the surface, *i. e.*, small, protruding, greyish-white masses, of the size of a small seed, semeed to be imbedded in the brown-red parenchyma of the organ. These granular masses formed thus numerous, small, whitish-coloured islands between the dark lines of the hepatic tissue surrounding them. On section, the liver was anæmic, bright coloured, very firm and resistent, the cut surface shining like wax. It was everywhere interspersed with little greyish-white masses, which had not only the round form, as on the surface, but also that of longer and shorter striped figures.

These round granular masses were continued into those of a linear shape, so that the connexion between these two kinds of bodies was not to be mistaken. The *spleen* was greatly enlarged, weighing 1½ lbs., irregularly notched at the edge; the surface of the same smooth, tight, resistent; parenchyma anæmic, of a bright-red colour, homogeneous, resembling wax; follicles not visible; trabeculæ indistinct.

The left *kidney* of usual size; on its otherwise smooth surface was seen a cyst of the size of a pea. Capsule of the kidney easily separated. Cortical as well as medullary substance remarkably pale, very firm, homogeneous, and shining. Malpighian corpuscles distinct. The *right* kidney showed, as regards consistence, colour, and texture, the same condition as the left, but it was somewhat increased in breadth. In the lower part of the *small intestine* not only closely aggregated solitary glands, but, besides these, numerous small punctated swellings of the mucous membrane were seen.

The interest of the above case is concentrated chiefly on the pathological products found in the liver and kidneys.

In the liver the microscope shewed that the above-mentioned greyish-white islands, were composed, for the most part, of closely aggregated nuclei, in some of which a nucleolus was distinctly seen, but the greater number had no nucleolus, and presented a more homogeneous, shining, rigid appearance. The nuclei did not appear completely spherical, but had lateral surfaces as if they had been flattened against each other by pressure. Besides the nuclei there were seen here and there larger structures, viz., small, slightly granulated cells, in which the nucleus appeared after the addition of acetic acid, but always closely surrounded by the cell-wall. Divisions of the nucleus were never observed; there was never more than one present which almost completely filled the whole cell. The above nuclear structures were seen to be embedded in a finely fibrous mass, in some places more abundant than in others, so that sometimes the latter, sometimes the nuclei, were the most prominent objects. The nuclei were especially numerous in the centre of the granular masses. When one of these grains was isolated, brought under the microscope, and slightly pressed, there came out of the centre a mass, consisting almost entirely of nuclei, while the sides of the granular body possessed a membranous consistence, but were everywhere interspersed with these nuclear products. The above-mentioned granular bodies seen on the surface of the organ, were not isolated grains imbedded in the liver substance, but, on section of the latter, they were seen to be continued as stripes or prolongations,

dipping for some distance into the liver-parenchyma. If one of these were isolated as much as possible, the granular body could be seen attached to the end of the prolongation, as it were on a stalk or style; and sometimes two granular bodies could be isolated, and seem to be on one common style. The deep end of the style had a fringed appearance, and looked as if it had been torn. When carefully examined, these prolongations or styles were seen to be vessels, in the walls of which numbers of these nuclear products lay. Sometimes the calibre of the vessel was thereby only narrowed, sometimes however it was entirely closed. It was possible, with some trouble, to trace from a large vascular trunk to a minute branch, having one of these granular bodies attached to its end.

On examining sections of the liver, hardened by chromic acid, by a low power of the microscope, these granular bodies, composed of a thickly aggregated mass of new products, seemed as if separated by a sharp boundary line from the proper hepatic substance, and as if they had pushed aside the liver-cells to make room for themselves, but when more highly magnified, at the apparent line of separation between them and the hepatic substance, nuclei were seen to be continued from the former, between the individual liver cells. The latter were wider apart than natural, and sometimes considerable numbers of nuclei were seen in the intercellular spaces. When the nuclei were less numerous, the intercellular substance could be seen to possess a distinctly fibrous structure. Nowhere could the nuclei be surrounded by cell-wall so as to indicate their origin from the corpuscles of the connective tissue.

It was very much easier in the kidneys to demonstrate the mode of origin of these new products. On placing sections of the cortical substance under the microscope, masses of these nuclei were seen imbedded in the connective tissue, occupying the spaces between the tubuli uriniferi, and between the latter and the Malpighian corpuscles. In these situations the nuclear bodies were in groups of 3, 4, and 5, or more, until they were so numerous that they could no longer be counted, and in many places were in a distinctly circumscribed space; sometimes indeed they could be distinctly seen occupying the interior of long-shaped bodies, the corpuscles of the connective tissue, thus showing the origin and development from the latter. That this circumstance was only seldom seen distinctly is not to be wondered at, when we consider how difficult it is to trace the development, *e. g.* of tubercle in the tissues.

In many places in the kidneys, the tunica propria, was seen to be thickened by the deposition of these nuclei, and the calibre of the tubes consequently diminished. In the course of the

vessels the development of the new products had attained such an extent, that they formed broad bands of closely aggregated nuclei, resembling strongly those in the liver. Under these circumstances only remnants of the tubuli uriniferi in the neighbourhood were to be seen; sometimes even they were entirely destroyed; the latter, however, was rarely the case. These nuclei in the kidneys were all of much the same size; they were slightly granulated, and were provided with one or two distinctly visible nucleoli.

Between the straight tubes, at the bases of the pyramids, were sometimes seen single, sometimes double and triple rows of these nuclei.

Boettcher thinks it extremely probable that the vessels connected with the granular bodies in the liver were lymphatics, but he cannot say this with certainty. If this conjecture be correct, more strength is given to the supposition of a relation between the corpuscles of the connective tissue and the lymphatic vessels. For, in the case before us, we have Leukæmia, a hypertrophy of the lymphatic glands, and, at the same time, new products in the liver and kidneys, resembling the lymphatic elements, those in the former organ connected, in all probability, with the lymphatic vessels, and those in the latter, distinctly seen to be developed from the corpuscles of the connective tissue.

The pathological products above described were found only in the cortical substance of the kidney, and in the bases of the pyramids. The tubular epithelium of the middle and of the apices of the medullary portions was destroyed, while that of the bases of the pyramids and of the cortical substance was well preserved.

There was an interesting pathological change in the vessels of the pyramids, and, in a slight degree, of those of the cortical substance also. The arteriolæ rectæ were in many places rigid, very brittle, and of a homogeneous shining appearance. On section, the walls were seen to be variously thickened, whereby the calibre of the vessel was diminished, and sometimes to such an extent that the cavity appeared only as an oval or star-shaped slit. Sometimes the above-described pathological change affected the whole length of the arteriole, sometimes only a part of it. Tr. iodinei and sulphuric acid caused the diseased portions of the vessels to become of a violet colour. In the cortical substance, only the larger trunks of the vessels were slightly diseased, while the glomeruli and the afferent and efferent vessels of the same were not at all affected.

As regards the *spleen,* both in fresh preparations and in those hardened by chromic acid, besides the well-known

spindle-shaped bodies, only a thickly aggregated mass of young cells and nuclei were to be seen, which sometimes lay quite free, sometimes were imbedded in a fibrous tissue and possessed a homogeneous, rigid appearance. Neither the trabeculæ nor the follicles were distinctly seen.

In the mucous membrane of the *intestine* there were observed, besides the normal solitary glands, numerous granular masses, varying from the size of minute points to that of the solitary glands. The smallest were seen only on holding the intestine up to the light, when they were perceived as numerous very minute points imbedded in the structure of the intestine. These granular bodies, both larger and smaller, were seen, under the microscope, to be composed of elements resembling the lymphatic corpuscles, quite similar to the pathological products in the liver and kidneys. The connexion of these granular bodies with the intestinal structure was not made out.

In Leukæmia the spleen is always enlarged, but it may present after death two distinctly different appearances:—

1. Although the organ may be greatly hypertrophied, its substance may present a perfectly normal appearance.

2. Along with the enlargement, the parenchyma may be firm, very resistant, of a bright red, greyish, or brownish colour, and of a homogeneous, dry, dull, shining appearance. This resembles very closely what has been described as the waxy spleen. In the majority of cases of Leukæmia we have the latter condition—hypertrophy of the spleen along with induration of its structure: the latter is by no means characteristic of the disease; on the contrary, the same kind of induration may occur in other affections. Of course, when we have both hypertrophy and induration of the organ, the former state has preceded the latter; therefore these conditions afford some good information regarding the duration of the disease of the spleen.

In Boettcher's case, the spleen gave the usual violet colour reaction with the tincture of iodine and sulphuric acid, as in the waxy spleen.

In the liver, also, a series of similar changes, as in the spleen, is sometimes observed. Often, indeed, in Leukæmia this organ is not at all changed: when it is so, it is always enlarged, and sometimes merely simply hypertrophied, sometimes also indurated, and showing the appearance and reaction of the waxy degeneration. In Boettcher's case, the liver was indurated as well as enlarged, and gave the violet colour with tincture of iodine and sulphuric acid, but only on those parts where the pathological products were present. The liver-cells were not affected by the reagents. The induration, therefore, seemed thus only to have affected the *new* formations in the liver.

Thus was demonstrated, chemically, an identity between the pathological change in the liver and spleen in the case before us and that supervening in other diseases. It is extremely probable that, in the later period of the malady, the morbid conditions of the liver and spleen had little effect upon the development of the Leukæmia, as although these organs must have become enlarged, they must have afterwards undergone the waxy degeneration. It is more likely that the hypertrophy of the lymphatic glands was the most essential thing in the development of such large quantities of colourless blood corpuscles.

In the cases of Leukæmia related in medical literature, it has been observed that when the liver and spleen were found, after death, merely simply hypertrophied, this disease had run a rapid course, but that, when these organs were indurated as well as enlarged, the malady had progressed more slowly.

It was not an unimportant circumstance that, in the case before us, there was amyloid degeneration of the vessels of the pyramids of the kidneys, and no such degeneration of the new products in the cortical substance of the latter organs This showed that the production of the lymphatic elements in the kidneys was of a later date than that of the same in the liver and spleen, and the renal vascular affection. The comparatively recent origin of the pathological formations in the cortical substance of the kidneys was also indicated by the small number of the nuclear masses, and by some of them distinctly occupying the interior of corpuscles of the connective tissue. Boettcher thinks it probable that this older disease of the vessels of the pyramids, by inducing congestion of the cortical substance, may have predisposed to the pathological change in the latter.

The interesting points in the above case are:—

1. The production, in a well-marked case of Leukæmia, of numerous nuclear structures resembling the lymphatic elements in the liver, kidneys, and intestine, thus shewing what Virchow has called the lymphatic diathesis.

2. The close connexion of these nuclear structures in the liver with, in all likelihood, lymphatic vessels.—This, taken along with the probable development of all these nuclear products from the corpuscles of the connective tissue,strengthens the supposition of the close relation of the lymphatic vessels with these corpuscles.

3. The long duration of the disease, and the waxy indurated appearance of the liver, spleen, and kidneys, seen after death.

4. The affection of the cortical substance of the kidneys, certainly of a more recent date than that of the vessels of the pyramids, thus showing a mechanical cause as predisposing to the development of disease in an organ.

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Glasgow Medical Journal.

Journal de la Physiologie de l'Homme et des Animaux, publié sous la direction du Docteur E. Brown-Sèquard.

American Medical Monthly.

New York Journal of Medicine.

Journal of Practical Medicine and Surgery. English Edition.

Quarterly Journal of Dental Science.

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North American Medico-Chirurgical Review.

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Guy's Hospital Reports.

*** The Editor will be happy to exchange with other Journals.

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J. Hughes Bennett, M.D., Outlines of Physiology.

A. M. Edwards, F.R.C.S., Introductory Address to his Lectures on Surgery.

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John Syer Bristowe, M.D., An Introductory Address delivered at St. Thomas's Hospital.

T. W. Nunn. F.R.C.S., Observations and Notes on the Arteries of the Limbs.

J. Toynbee, F.R.S., A Case of Deaf Dumbness, from the Proceedings of the Med.-Chir. Soc.

Ch. Robin, M.D., Prof. Agrégé, &c., Sur quelques points de l'Anatomie, et de la Physiologie de la Muqueuse et de l'Epithélium Utérin pendant la Grossesse.

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J. M. O'Ferrall, Esq., M.R.I.A., On Hospital Instruction.—An Introductory Address.

Arnold Beer, Die Bindesubstanz der menschlichen Niere im Gesunden und Krankhaften Zustande.

F. D. Schmidt, M.D., Philadelphia, On the Minute Structure of the Hepatic Lobules, particularly with reference to the relationship between the Capillary Blood-vessels, the Hepatic Cells, and the Canals which carry off the Secretion of the latter.

INDEX.

EXPLANATION OF THE PLATES.

The scales at the bottom of each plate represent hundredths or thousandths of an inch magnified in the same degree as the object delineated.

Plates I, II, III, and IV, were taken from different parts of the same liver. The manner in which they were prepared is described in page 21.

Plate I.

Portions of three adjacent Lobules of the Liver of the Pig, in which the capillaries of the portal vein have been injected. The interlobular fissures are also seen with the small branches of the portal vein. The duct and artery are not represented, as they have not been injected. The fibrous appearance caused by these vessels not being distended with injection, and by the presence of a little fibrous tissue is too coarsely indicated in the drawing. In the natural state of the parts the meshes of the capillary network are occupied by the cell-containing network, but the cells are not represented in the plate for the purpose of avoiding confusion.

Plate II.

Small Intralobular Branch of the Hepatic Vein in a small Lobule of the Pig's Liver.—The curved line shows the boundary of the lobule. Capillaries are observed to open into the small trunk in every part of its course, while in the case of the portal vein, small branches are given off from the interlobular branches at intervals, and penetrate the capsule to enter the lobule, as represented in plate I.

Plate III.

Branches of the Artery on the Surface of the Pig's Liver, injected.—By the communications between these vessels at various points, an arterial network is formed. Many small

branches pass downwards from this network, and become connected with the capillaries of the lobule. Such points of communication are represented at *a*. It was considered desirable not to introduce more for fear of giving to the drawing a confused appearance.

Plate IV.

Fig. 1. *Small Branch of Interlobular Duct, with Branches to Lobules; from the Liver of the Pig.*—The point of junction between the smallest duct and the tube of the cell-containing network is seen at *a*. The tubes of the network are much distended with injection, which has run between the cells so as to separate them some distance from each other, and from the walls of the tube.

At *c*, some of the epithelial cells lining the duct at the narrowest part of its course are represented.

Fig. 2. Another specimen, showing the same points.

Figs. 3, 4, 5, 6. *Small Interlobular Ducts,* showing their mode of branching on the surface of the lobule. Although the branches injected are very numerous, it is probable that not nearly all have been injected.

Plate V.

Thin Section of the Liver of the Ox, in which the Portal Vein had been injected.—The injection, however, has only penetrated the capillaries situated at the outer part of the lobules. The dark parts show the position of the injected vessels, while the lighter granular portions correspond to the central part of the lobule into which the injection has not penetrated.

a. Situation of the portal canals.

b. Intralobular vein divided.

Plate VI.

Thin Section of the same Liver, but taken from a part in which the Hepatic Vein had been injected.

a. Portal canals. The portal vein not injected in this specimen.

b. Situation of the intralobular or hepatic vein which had been injected. The injection had escaped from the trunks when they were divided in making the section, and hence the clear round spaces seen in the drawing.

Plate VII.

Fig. 1. *Thin Section of a Liver containing numerous Cysts* (p. 31).—The tubes of the cell-containing network are seen to be thin and wasted.

a. Small cyst in an early stage of formation, situated between the circumference and central part of the lobule.

b. Portion of the lobule near the portal canal. Oil-globules are more abundant in this part of the network than in other situations.

Fig. 2. Portion of a lobule from the same liver in which this morbid change had not taken place.

c. Intralobular vein.

d. Small portal canal containing a branch of the duct.

e. The epithelium, very distinct.

Plate VIII.

Fig. 1. *Section of a Liver, in which the Common Bile Duct was obstructed by a Growth at its Orifice* (p. 29).—In this liver the ducts were much dilated, and in some instances the dilatation had extended to the tubes of the cell-containing network. Rupture of the tube had probably taken place, and the bile consequently escaped into the meshes of the network. As the cavity thus formed increased in size, a few of the tubes of the network became stretched across it, and in this manner the appearance represented in the figure has been produced.

Fig. 2. Another small cavity, with attenuated tubes stretched across it.

Fig. 3. Appearance of a section of the liver under a low power, showing the dilated ducts and cavities in the cell-containing network.

Fig. 5. *Small Portal Canal with a few Branches of the Duct injected.*—From the same liver as the drawings figured in plate VII were taken.

Fig. 6. Portion of the cell-containing network of the liver figured in plate VII, isolated. The tubes contained cells, and a very small quantity of injection. The granular character which the membrane presented in this case is well shown in the drawing.

⁂ The two figures last described in plate VIII, should have been figured 4 and 5, instead of 5 and 6.

Plate IX.

Fig. 1. *Portion of a Mass expectorated* (p. 49).—The tubes figured in the drawing were occupied with some solid material which had assumed a granular appearance.

Fig. 2. Part of a tube, probably an altered capillary vessel containing a few blood corpuscles and small granular cells.

Fig. 3. *Portion of Tumor removed from the Neck.*—The fibres are too coarsely represented in the drawing, page 51.

Fig. 4. *Tumor Connected with the Corpus Striatum,* consisting almost entirely of the ganglion cells, represented in the drawing. At the upper part of the figure is seen a small vessel with some fibres of yellow elastic tissue.

Fig. 5. Fibres of yellow elastic tissue abundant in some parts of the tumor.

Plate X.

Large Bile-Ducts of a Squirrel injected.—The small figure represents the same of the natural size, with a section of the gall-bladder. The position of the two figures is reversed, but the letters refer to the same parts in both drawings.

a. Common duct.
b. Cystic duct.
c. Left hepatic duct.
d. Right hepatic duct.

It will be observed, that the duct *b* opens directly into the common duct, while the duct *c* joins the cystic duct at a point above this. Between the two last is observed an intimate plexus of smaller ducts through which they communicate very freely with each other. This plexus also receives small trunks from the lower surface of the liver. All the hepatic ducts and the cystic duct contain in their coats numerous little cavities or sacculi, while the coats of the common duct are almost entirely free from them.

These peculiarities in the arrangement of the ducts of the squirrel's liver will be fully described in a future paper.

Plate XI.

Illustrates Dr. Alison's Paper on Measuring the Chest.

Fig. 1. Chest of a girl, 14 years of age, suffering from pulmonary consumption.

Fig. 2. Lateral curvature of the spine in a case of phthisis.

Fig. 3. Chest of a youth, suffering from great hypertrophy of the heart, with deficiency of the semilunar and mitral valves.

Plate XII.

Illustrates Dr. Farre's Observations on Exfoliation of the Epithelial Coat of the Vagina.

Fig. 1. A sheath of epithelium spontaneously expelled from the vagina of a young woman, forming a nearly complete cast of that canal. The outer surface, which is shewn in this figure, exhibits numerous pits and furrows, forming casts of the vaginal rugæ. At the upper part is an aperture where the cervix uteri was inserted; within this hangs a loose conical flap of epithelium, which had covered the two lips of the os uteri.

Fig. 2. The same preparation laid open and viewed from within. The pits and furrows of the reverse surface in fig. 1 appear in this view as the ordinary rugæ of the vagina. The conical flap of epithelium which had invested the vaginal portion of the cervix is more plainly seen.

Fig. 3. Another preparation from a married woman who had borne children. The vaginal rugæ are nearly obliterated. This specimen serves to exhibit the true form and dimension of the vagina, of which it forms a complete cast. At the upper part is the conical depression into which the cervix uteri had been inserted. A transverse slit in the centre of this corresponds with the os tincæ. The peculiar flattened crescentic border, in whieh the preparation terminates above, corresponds with the fornix. At the opposite extremity the aperture with the puckered margin forms the ostium vaginæ.

Fig. 4. A less perfect cast from another case, also a married woman. The vagina is here considerably wider; the peculiar flattened border shews also a deeper and wider fornix.

Fig. 5. *a.*—Scales of nucleated pavement epithelium, of which all these casts are composed.

b.—The same in profile.

Plate XIII.

Illustrates Mr. Hulke's Observations on Bony Tumours.

Fig. 1. Enchondromatous tumour of the tibia.

a.—Old bone.

b.—Ossified enchondroma, containing large nuclear cavities.

Fig. 2. Lacunar cavities from enchondroma of the tibia.

Fig. 3. Myeloid cell in an irregular cavity, like an Haversian space.

Fig. 4. A vertical section through the articular cartilage of the inner condyle of the femur, showing the transformation of cartilage cells to myeloid.

a.—Cartilage cells in transition. *b.*—Bone.

Fig. 5. Dendritic growth of the myeloid matrix, or intercellular substance.

Fig. 6. A vertical section through the first phalanx of a toe. It shows the articular layer of bone with large lacunar cavities (*a.*) in it.

Plate XIV.

Illustrates Dr. Beale's Paper on the Lymphatics of the Liver.

Fig. 1. Lymphatics from the surface of the liver of the ox, injected with Prussian blue. These vessels are on different planes, some being in the substance of the fibrous capsule, others immediately beneath it. The position of the valves is marked by the accumulation of injection in front.

Fig. 2. Vessels showing the mode of branching, more highly magnified.

Fig. 3. Some of the smallest branches, shewing a network, without any blind extremities.

Plate XV.

Illustrates Dr. Beale's Observations on Cirrhosis.

Fig. 1. Thin section of a liver in which the common duct was obstructed, page 125. The lobules are much diminished in size, while the interlobular fissures have increased in diameter.

a.—Wide interlobular fissures.

b.—Remains of several lobules, which have diminished in size from the circumference towards the centre.

In this section almost every lobule is seen to be separated from its neighbours by a distinct interval.

Fig. 2. Thin section of a cirrhose liver.

a.—Wide spaces intervening between lobules, or collections of wasted lobules.

b.—The remains of several lobules, scarcely to be distinguished by examination with a low power from the interspaces *a.*

In this section the shrivelled lobules are, for the most part, collected into masses, which are separated from each other by large interspaces, corresponding to the larger portal canals of the healthy liver.

Both sections are magnified in the same degree, and the appearances should be carefully compared.

Plate XVI.

Illustrates Dr. Beale's Observations on Cirrhosis.

Fig. 1. Degenerated capillaries of lobule of cirrhose liver. The walls, *a*, are granular, and contain several oil-globules.

b.—Lines of oil-globules, marking the position of capillaries which have wasted.

c.—Structures representing cells, but perfectly clear and transparent, not in any way resembling the "liver cell."

Fig. 2. Capillary vessels, the coats of which contain very numerous oil-globules. These vessels have ceased to transmit blood, and the outline of their walls is only to be distinguished in some situations.

Fig. 3. Altered cells and colourless masses, apparently consisting of some albuminous material from a lobule.

Fig. 4. Smallest branches of the duct in an interlobular fissure, injected. These were probably situated close to the margin of a lobule.

Fig. 5. Part of an interlobular fissure, in which the veins have been injected.

a.—Small branches of the portal vein, injected.

b.—Small branches of ducts, containing oil-globules, debris, and granular matter.

c.—Intervening granular material, containing small branches of vessels altered by disease, and not visible in the preparation.

Fig. 6. Branches of duct in an interlobular space, injected.

Fig. 7. Intralobular hepatic vein, injected. A very few capillary branches are seen passing from this to a short distance. On the left are observed two large branches which establish a tolerably free communication between the branches of the portal and intralobular veins. In consequence of the great force required to force in the injection, slight extravasation has occurred.

Plate XVII.

Illustrates Dr. Beale's Observations on the Anatomy of the Lobules of a Liver in which the Common Duct was obstructed. Also Fig. 1, *Plate* XV.

Fig. 1. Section in which the ducts are injected.

a.—Interlobular spaces with injected ducts.

b.—Remains of lobules.

Fig. 2. Arteries in an interlobular fissure, injected. The branches are more numerous, and the trunks larger than in the healthy liver.

Fig. 3. Section of the liver, showing branches of the portal vein injected, with the interlobular spaces, and shrunken lobules.

a.—Branches of the portal vein. *b.*—Lobules.

c.—Branch of intralobular vein, injected.

d.—Capillaries of lobule, permitting injection to pass through them very readily.

Fig. 4. Ducts, and commencement of secreting network of the lobules. The liver-cells have receded, leaving the tubes narrow, and thus contain only granular matter and oil-globules.

Fig. 5.—Another portion of the network.

Fig. 6.—Branch of intralobular vein, with capillaries well injected. This figure contrasts remarkably with fig. 7, pl. XVI.

Plate XVIII.

Illustrates the results of Dr. Beale's Examination of a Cancerous Liver, sent by Mr. Robert Ceely, of Aylesbury.

Fig. 1. Represents the appearance of a section of the liver. Natural size.

Fig. 2. A small portion of the same, magnified six diameters.

a.—Collections of white cancerous material.

b.—Intervals between the collections, appearing tolerably transparent when examined by transmitted light.

Fig. 3. Represents a few of the tubes of this network, filled with cells, and magnified 215 diameters.

Fig. 4. A portion of one of the white spaces, which was traversed in all directions by a network containing small cells. The part represented is situated near *a*, fig. 2, but is more highly magnified.

Plate XIX.

Illustrates Dr. Munroe's Case of Rape. Deposit from Liquor Amnii, and curious forms of Crystals of Uric Acid.

Fig. 1. Spermatozoa, &c., from stain on linen in a case of rape.

a.—Cells of vaginal epithelium. *b.*—Blood corpuscles.

c.—Spermatozoa. *d.*—Flax fibres. *e.*—Mucous corpuscles.

Fig. 2. Deposit from liquor amnii, in the eighth month of pregnancy, containing numerous large cells of scaly epithelium from the vernix caseosa.

a.—Collection of oil-globules. In the upper part of the figure some spiculæ of crystalline fat are seen.

Fig. 4. Cells differing in form from those above described, and resembling bladder epithelium. It is probable that they are really derived from the bladder, but this cannot be stated with certainty.

Fig. 3. Very curious forms of crystals of uric acid, *a.*

b.—Sporules and thalli of penicilium glaucum.

c.—Octohedral crystals of oxalate of lime.

Fig. 5. Other crystals from the same specimen of urine.

Plate XX.

Illustrates Mr. Lockhart Clarke's Paper on the Anatomy of the Spinal Chord. Page 200.

Fig. 1. Transverse section through the lower part of the *conus medullaris* of the cat. *a.* Posterior column; *b.* posterior grey substance; *c.* network of grey substance inclosing longitudinal bundles of the lateral column; *d.* anterior grey substance, or cornu; *e.* anterior median fissure; *f.* central canal lined by *epithelium.*

Fig. 2. Transverse section of the grey substance of the upper part of the *conus medullaris; g.* gelatinous substance; *h.* cut ends of the longitudinal and oblique fibres in the *opaque* portion of the *caput cornu;* immediately in front of this portion, the grey substance is pierced by a multitude of separate longitudinal bundles, represented by the dark spots; *i.* transverse bundles of the posterior roots of the nerves; *j.* decussating fibres of the anterior commissure.

Fig. 3. Transvere section of one-half of the grey substance, a little below the middle of the lumbar enlargement. *l.* Posterior vesicular column.

Fig. 4. Transverse section of the entire grey substance, at the upper part of the lumbar enlargement. *l.* Posterior vesicular column, *m. tractus intermedio-lateralis.*

Fig. 5. Similar section through the middle of the dorsal region.

Fig. 6. Similar section through the upper part of the dorsal region *m.* tractus *intermedio-lateralis; l.* posterior vesicular column.

Fig. 7. Section of one-half of the grey substance through the middle of the cervical enlargement. *o.* Longitudinal bundles of fibres in the outer half of the *cervix* cornu; *n.* posterior transverse commissure.

Plate XXI.

Illustrates Mr. Clarke's Paper on the Anatomy of the Spinal Chord. Page 200.

Fig. 8. Similar section to that in Fig. 7, Plate XX, at the fourth part of cervical nerves. In the outer part of the *cervix* cornu the longitudinal bundles have become larger and more numerous, and are inclosed in a network of the grey substance;

through and *in front* of this network, the lower roots of the spinal-accessory nerve *p*. bend forward and reach the cells of the *anterior* cornu, where they mingle with the *anterior* roots of the spinal nerves, to which it may therefore be considered as partly belonging. According to Bendz and Claude Bernard, these lower roots of the spinal-accessory nerve are all collected together in its *external* branch, which is well known to be distributed to the *sterno-cleido-mastoideus* and *trapezius* muscles; while the *upper* rootlets of the spinal-accessory *alone* constitute its *internal* branch which is distributed with the *vagus* to the larynx and pharynx.*

Fig. 9. Similar section through the dorsal region of the rat. The posterior grey substance is not united into a single mass as in the cat, ox, &c., but is separated into two dictinct cornua. *o*. Longitudinal bundles in the outer part of the cervix cornu.

Fig. 1. Longitudinal section through the cervical enlargement of the spinal chord of the cat, from the eighth to the twelfth pair of nerves. P.C. Posterior white column. A.C. Anterior white column. G. Grey substance between the white columns. P. Posterior roots of the nerves, consisting of three kinds,— *a*. *b*. and *c*. A. Anterior roots of the nerves. A.C. a portion of the anterior column, showing the arrangement of the longitudinal fibres.

Fig. 2. A transverse section through one-half of the lumber enlargement, representing the course of the fibres of the roots of the nerves, and of the transverse commissures through the grey substance. The vesicles have been omitted to prevent confusion. The fibres of the anterior roots *i*. *i*. on reaching the grey substance are seen to diverge and cross each other; and those of the posterior roots, in the cervix cornu posterioris, are seen intersecting each other in every direction.

Plate XXII.

Illustrates Dr. Beale's Paper on the Matrix of the Kidney. Page 225.

Fig. 1. Section of the cortical portion of a kidney, the vessels of which have been injected with the Prussian blue solution.

* Claude Bernard, "Leçons sur la Physiologie et la Pathologie du Systêm Nerveux." Tom. ii. p. 279 et sequent: (Baillière, 1858).

a.—Membrane of the tubes. The *a.* to the right of the figure shows the position of a Malpighian body.

b.—A portion of a capillary loop of a Malpighian body.

c.—Venous capillaries lying between the uriniferous tubes. In many places the double shaded line indicates the basement membrane of the tubes.

d.—Position of the uriniferous tubes.

Fig. 2. Transverse section at the base of a pyramid.

Fig. 3. A similar section a short distance lower down, showing sections of the uriniferous tubes. The small tubes join the larger ones at a point lower than that at which the section is made.

Fig. 4. Section nearer the apex of the pyramid.

Fig. 5. Apex of a pyramid showing the manner in which the uriniferous tubes open into the pelvis of the kidney.

Plate XXIII.

To illustrate Dr. Beale's Observations on Congestion of the Liver. Page 229.

Fig. 1. Plan of a few lobules of human liver. Portal capillaries much congested.

Fig. 2. The same plan. Hepatic-venous capillaries slightly congested. Branches of portal vein containing no blood.

Fig. 3. The same. Congestion of the central capillaries has proceeded to such an extent that the congested part of one almost reaches to corresponding portions of its neighbours. The appearance very closely resembles Fig. 1, and in nature the branches of portal vein being transparent and empty, the chance of mistake is very much increased.

Fig. 4. An accurate copy of a few lobules of a healthy human liver. The capillaries are not injected. The branches of the hepatic vein are tinted.

Fig. 5. The same as Figs. 1, 2, 3. The portal capillaries are partially congested and the central parts of the lobules contain much biliary colouring matter.

Fig. 6. A single lobule of human liver. The central capillaries near the hepatic vein are shaded very dark. The marginal capillaries connected with the portal veins are represented paler. Only part of the space has been filled up by the artist. It is hardly necessary to say that in nature the whole of this is occupied with capillaries.

Plate XXIV.

To illustrate Dr. Murchison's Paper on Melanotic Cancer of the Penis. Page 234.

Fig 1. Represents the penis taken about a month before death. The penis is lying over a fold of linen, its dorsal surface uppermost.

Fig. 2. Nucleated cells and colouring matter from melanotic tumor. On the right, a portion of the fibrous stroma is represented.

Fig. 3. Cells and colouring matter from punctiform deposits in one of the lymphatic glands close to the aorta.

Fig. 4. Cells loaded with pigment from the black pulpy substance contained in one of the inguinal glands.

Plate XXV.

To illustrate the form of large Spherules of Urate of Soda and Crystals of Diabetic Sugar. Pages 249, 250.

Fig. 1. Spherules of urate of soda. *a,* Small spherules, with large coarse uric acid crystals. *b,*
c, Small crystals.

Fig. 2. The same not so highly magnified.

Film composed partly of uric acid and partly of urate of soda.

Uric acid crystallized round a hair.

Fig. 3. Crystals obtained by the spontaneous evaporation of a drop of diabetic urine. A few rhomboidal crystals are observed in the lower part of the figure.

Fig. 4. Large tufts of similar crystals not so highly magnified.

Plate XXVI.

To Illustrate Messrs. Taylor and Hulme's Cases Illustrating the Use of the Ophthalmoscope. Page 284.

Fig. 1. Appearance of left eye of Wm. Mackay (Case 1, p. 285) upon examination with the ophthalmoscope. The cornea, lens, and its capsule, and the vitreous are clear. The optic disc appears strongly shaded, especially towards the temporal side. General hyperemia of the optic disc which is greater near the nasal side, where the disc is marked with very fine bluish striæ. Retinal vessels rather more branched than usual; otherwise normal. The retina preserves its transparency. The choroid is also normal.

Fig. 2. Ophthalmoscopic characters of the left eye of Wm. Brown, aged 36 (Case 2, page 285). Optic disc of a dull grayish pink colour, with faint striæ of a more decided pink. The outer part of the disc is surrounded for about two-thirds of its circumference with a line of black pigment, while the remainder towards the outer side appears shaded as if the disc were slightly elevated above surrounding parts. The vessels of the art. cent. retinæ are much enlarged and their contents have not the bright tint of arterial blood. Several of the vessels are bordered on each side by a fine white line, probably caused by the effusion of plastic exudation. The entire retinal surface is of a much brighter red than in the healthy eye, and presents a velvety appearance which completely conceals all trace of the choroidal vessels, as well as of the macula lutea.

Figs. 3 and 4. Right eye of John Devine, aged 39 (Case 3, page 286), which was damaged 22 years ago by a blow. Capsule of lens suspended in its ordinary position. The nucleus of the lens remains unabsorbed at the bottom of the capsule. The two fine lines shown in fig. 4 are the remains of the suspensory ligament as seen when the patient is made to look upwards to the ceiling. Two small patches of uvea are seen on the inner side of the capsule.

Fig. 6. Right eye of Mary Smith (Case 4, page 286), showing appearance of the optic disc when the eye is everted. The edge is not circular and clearly defined as it should be, and the surface of the disc is highly injected with numerous fine vessels, to such an extent on the outer side that the continuity of its

circumference is quite lost. Numerous small vessels are seen directed towards the macula lutea, and large tortuous branching vessels perforate the centre of the disc. Black pigment is seen deposited on the surface of the disc, as well as around its edge. The white, roundish, clear-cut spots are due to the bright sclerotic shining through the choroid which is atrophied and deficient in its pigment in those parts.

Fig. 5. Parts over the macula lutea of the same eye, when the patient is made to look directly forwards, showing extensive choroidal deficiency and irregular deposition of pigment.

Plate XXVII.

Illustrating Dr. Arthur Farre's Paper on the Structure of Diplosoma crenata, an Entozoon inhabiting the Human Urinary Bladder. Page 290.

Fig. 1. One of the largest and most perfect specimens of the entozoon, of the natural size. In the centre, at the upper part of the figure is the sharp twist or kink, where the body is most contracted. From this point each half gradually enlarges to a certain distance, but tapers again towards either extremity; the right half terminating, in this specimen, in a point, the left furnished with a lateral membranous flap. This half of the body shows the abdominal groove, and double crenate border. The right half, being spirally twisted, exhibits successive portions of the dorsal, lateral, and abdominal surfaces. This twisting is observable in many specimens. Towards the extremity of this half numerous fibrous cross-bands are shown.

Fig. 2. A smaller but very perfect specimen, representing the more ordinary size of the worm. In the right half the dorsal, and in the left half the ventral aspect, with the abdominal groove and crenate border, is shewn.

Fig. 3. A less perfectly developed specimen, in which the body is nearly smooth, exhibiting no trace of the ventral groove or the crenate border.

These three figures suffice to illustrate the principal varieties in form of this entozoon; but the intermediate gradations are so numerous, that, in many hundred worms passed by this

individual, scarcely two were found alike in every particular. Most of the specimens of the size of, or larger than fig. 2, exhibit, more or less perfectly, the crenate border and central abdominal groove with the corneous band. But these parts are generally absent in the thinner and smoother specimens represented by fig. 3, which are probably the younger or undeveloped worms. However variable the form of the specimen, the component tissues are alike in all.

Fig. 4. Magnified view of the central contracted portion of the worm, exhibiting the rough or broken surface often observed at this part. Leading up to this point are the terminations of the abdominal groove of either half. The inner angle formed opposite to this point cannot be obliterated by stretching, showing that the bending here, which is uniformly midway between the extreme points, is not accidental.

Fig. 5. Lateral view of a portion of the worm, showing the crenate border unusually distinct and perfect. $\times 8$.

Fig. 6. Abdominal view of another portion, showing the ventral groove in which the corneous band is contained. The crenations are much more distinct in one lateral border than in the other, as is usually the case. $\times 3$.

Fig. 7. *a.*—Portion of another worm. The ventral groove and double crenate border very distinct. *b.*—The crenate border alone, from another specimen. *c.*—Single crenature. *d.*—Portion of the opposite or plainer border. $\times 2$.

Fig. 8. Dorsal aspect of a portion of a worm.

Fig. 9. The white ramified cord, seen only on one occasion.

Fig. 10. Portion of the subventral corneous band, showing the arrangement of the cells. At the lower left hand corner are seen several of the peculiar zig-zag muscular fibres, which remained attached to the fragment after it had been pulled out of the groove. $\times 200$.

Fig. 11. Portions of the same specimen more highly magnified. Many of the cells exhibit the central pore or nucleus. Others are represented in different stages of fission. Where the cells lie closest several show a dentate margin.

Plate XXVIII.

Illustrating Dr. Arthur Farre's Paper on the Structure of Diplosoma crenata, an Entozoon inhabiting the Human Urinary Bladder.

Fig. 12. Portion of one of the crenatures from the lateral border. It is composed of parallel-lying fibres, terminating in still finer filaments, that ultimately form a net-work, contained between the layers of a structureless diaphanous membrane. $\times$ 200.

Fig. 13. Bundles of similar fibres, forming a brush-like margin, observed in many specimens on the opposite side to the crenate border, and elsewhere. *a.*—More dense bundle. *b.*—Separate fibres. *c.*—One of these more highly magnified, showing the transverse lines occasioned by close zig-zag foldings of the component fibres. $\times$ 100 and 420.

Fig. 14. Portion of the peculiar zig-zag muscular fibre, most distinctly seen in the transverse tegumental bundles fig. 18, and attached to the corneous band. Fig. 10.

Fig. 15. Nucleated and granular cells and fibres, composing the tegumental surface of the worm. $\times$ 420.

Fig. 16. Terminal portions of three zig-zag muscular fibres, as shown in fig. 14. In two of these the broken ends exhibit the component sarcous fibrils. $\times$ 670.

Fig. 17. Portion of parenchyma from the centre of the body. It consists of white filaments and granular cells. The filaments run chiefly in the longitudinal direction. The entire parenchyma of the worm is made up of this structure, with occasional zig-zag fibres in certain positions.

Fig. 18. Portion of the tegumental or outer layer of the worm, consisting of groups of nucleated cells arranged upon a diaphanous basement membrane. The latter is thrown into numerous ridges and furrows, occasioned by sub-lying longitudinal bundles of fibres, which are bound together by transverse cords composed of the fibres represented in fig. 14.

Plate XXIX.

To Illustrate Dr. Lionel Beale's Paper on the Straight Vessels (Vasa Recta) of the Pyramids of the Kidney. Page 300.

All the figures $\times$15.

Fig. 1. Section through the base of a pyramid of the human kidney which had been injected from the artery. *a.* and *b.* are branches of the artery, lying in the interval between the cortical and medullary portions of the kidney, and passing outwards towards the cortex. Some of the small branches coming off from these trunks are seen to terminate in the usual manner, by giving off small arteries to Malpighian bodies. Others pursue a more or less horizontal course, and anastomose very freely, so that if one or other of the trunks were obstructed at a point anterior to its division, the blood would be carried by these anastomosing branches into the trunk beyond the obstruction. Many anastomoses also occur between vessels coming off from the same trunk. Now, it will be observed at several points, that branches coming off from these horizontal vessels pass downwards into the pyramids (above and below *b.*), and divide into numerous straight vessels (*vasa recta*). This point is seen very clearly. In this preparation several of the bundles of straight vessels are seen to have their origin *direct* from an artery, but the *majority* are doubtless connected with the efferent vessel of a Malpighian body.

Fig. 2. Manner in which the efferent vessel from a Malpighian body (human) divides into a number of straight vessels.

Fig. 3. Different manner of branching of an efferent vessel (human).

Fig. 4. *a.*—Straight vessels from a Malpighian body. *b.*—A branch direct from the small Malpighian artery just before it becomes connected with the Malpighian body. *c.*—An efferent vessel probably from a Malpighian body, divided.

Fig. 5. Human Malpighian bodies with afferent and efferent vessels.

Fig. 6. Another showing a different manner of branching (human).

Fig. 7. Another (human).

Fig. 8. From the kidney of the mouse.

Fig. 9. From the hare.

Fig. 10. From the horse, showing some vessels coming off directly from the trunk of the artery (above *b*.). Others derived from the efferent vessel of the Malpighian body, *a*.

Fig. 11. Also from the horse, showing vessels coming off directly from the trunk of an artery.

Fig. 12. From the sheep.

Plate XXX.

To Illustrate Dr. Scott Alison's Paper on Blood Calculi (page 246), *and Mr. Michael's Case of Hydatids near the Placenta. Page* 320.

Fig. 1. Left kidney, weighing only 1½ oz.. The infundibula and pelvis are much dilated, and faint traces of the proper structure remain here and there. At the lower part of the drawing a portion of the cortical and medullary structure are represented.

Fig. 2. One of the large and two small black calculi which were found in the pelvis of the kidney.

Fig. 3. Calculus from one of the infundibula as large as a horse-bean (see page 246).

Fig. 4. Membrane with placenta. *a.*—Position in which the mass of the so-called hydatids was found.

Plate XXXI.

To Illustrate Dr. John W. Ogle's Case of the Formation of Vessels in the "False Membrane," found in the Arachnöid Cavity. Page 281.

Fig. 1 represents the microscopic structure (by a comparatively low power) of the young blood-vessels with the nuclei in their walls, situated in the substance of the membrane. Here and there fatty and calcareous matters (just over *a*) are seen in connection with the vascular walls.

Fig. 2 represents the same as the above as seen by a higher power. Masses of calcareous and fatty substance (above *a*) are also seen in the substance of the false membrane itself, as well as in connection with the vessels.

Plate XXXII.

To Illustrate the Anatomy of a Tumour under the Tongue. Page 318. *Softened Tissue of Optic Thalamus. Page* 288. *Blue Deposit in the Urine. Page* 311.

Fig. 1. Section of tumour situated under the tongue of a girl, aged 25. The dark shaded portions consist of fatty matter. *a.*—Separate cell membrane. *b.*—Ditto resembling cells of epithelium. The structure of this tumour is closely allied to that of a cholesteatomatous tumour.

Fig. 2. Softened cerebral tissue surrounding a clot in the optic thalamus and corpus striatum, showing broken nerve tubes and collections of mi[illegible] oil-globules (compound granular corpuscles or exudation globules).

Fig. 3. Indigo. *a.*—Small crystals obtained by sublimation. *b.*—Larger crystals obtained in the same manner. *c.*—Small crystals of indigo in fluid.

Fig. 4. Uroglaucine or indigo-blue, from the urine of Dr. Eade's case, reported in page 311. *a.*—Small collections of a pale blue colour, like Prussian blue. *b.*—A darker mass formed apparently of a number of small spherical masses. *c.*—The crystals of uroglaucine of a deep purple or violet colour.

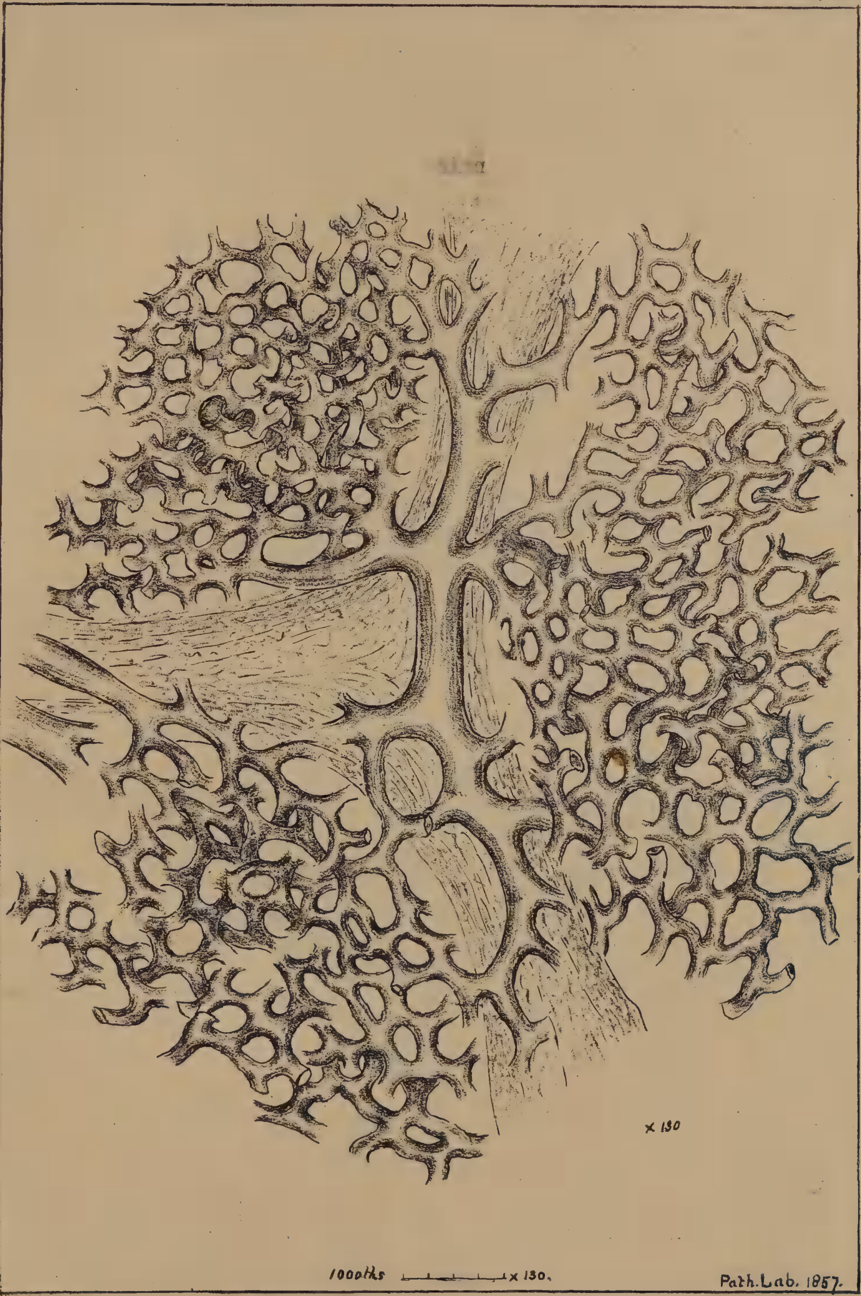
ERRATA IN "EXPLANATION OF PLATES."

Plate XXI., page ix., 3rd line from bottom,

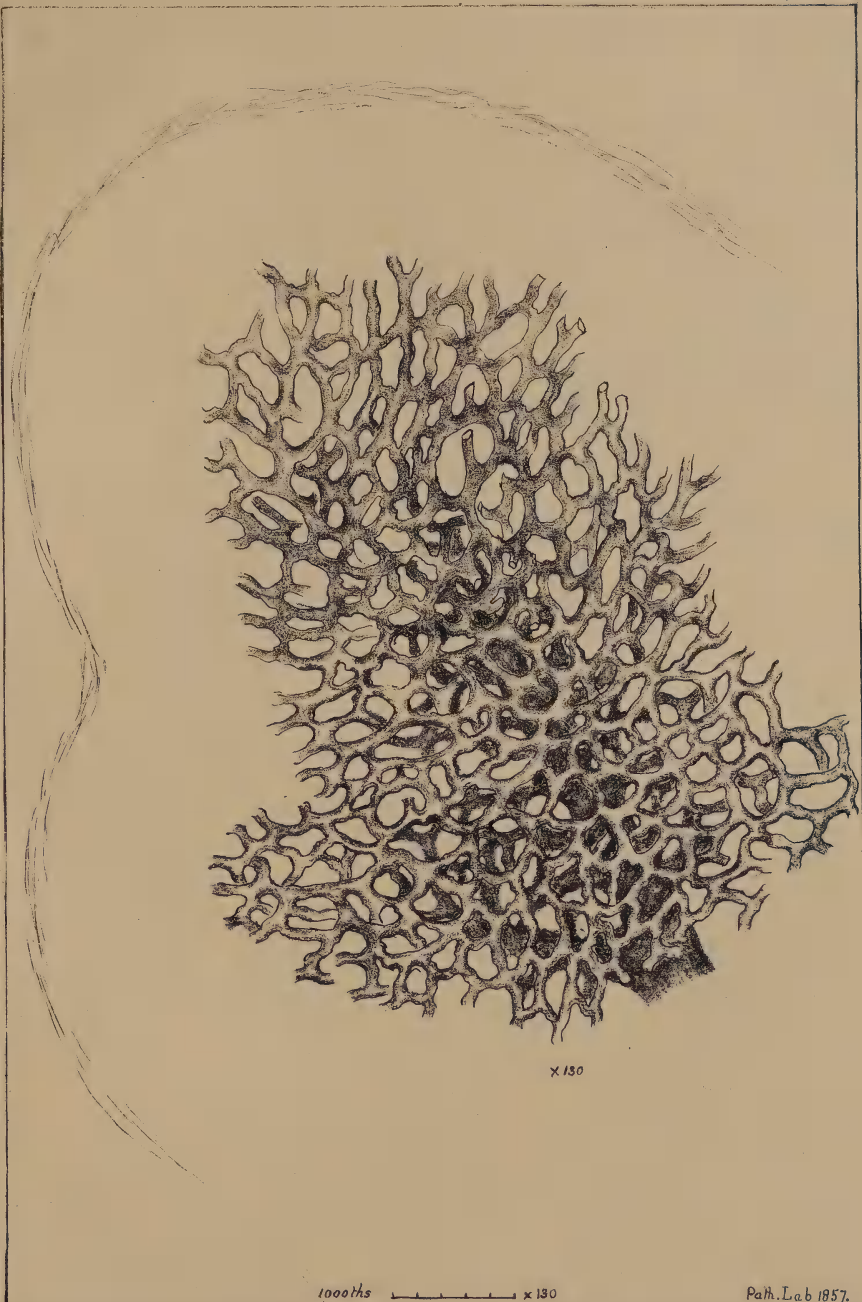
For "Part" read "pair."

Plate XXIII., page xi.,

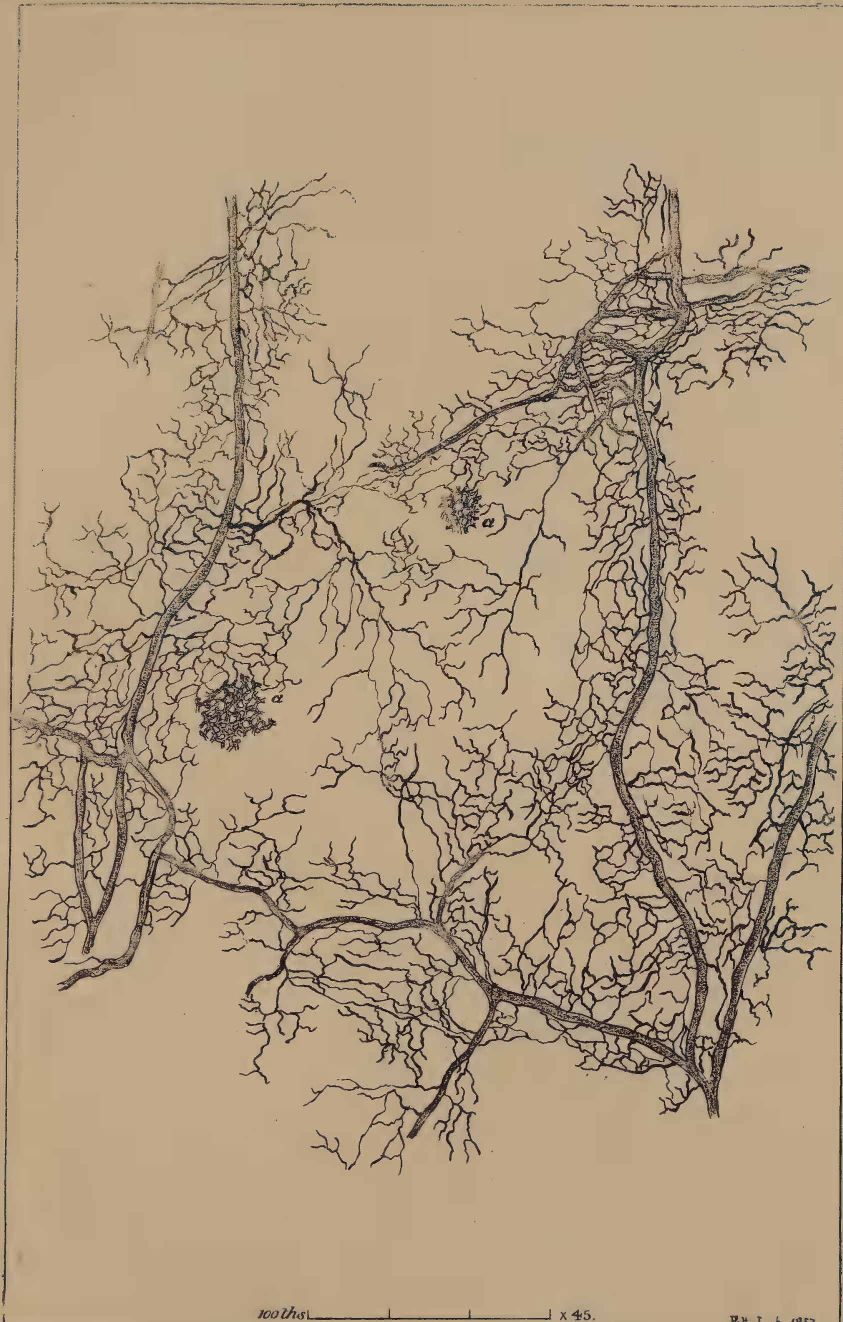
For "Fig. 1" read "Fig. 4."
For "Fig. 4" read "Fig. 1."



PORTAL VEIN PIG'S LIVER. SECTION.

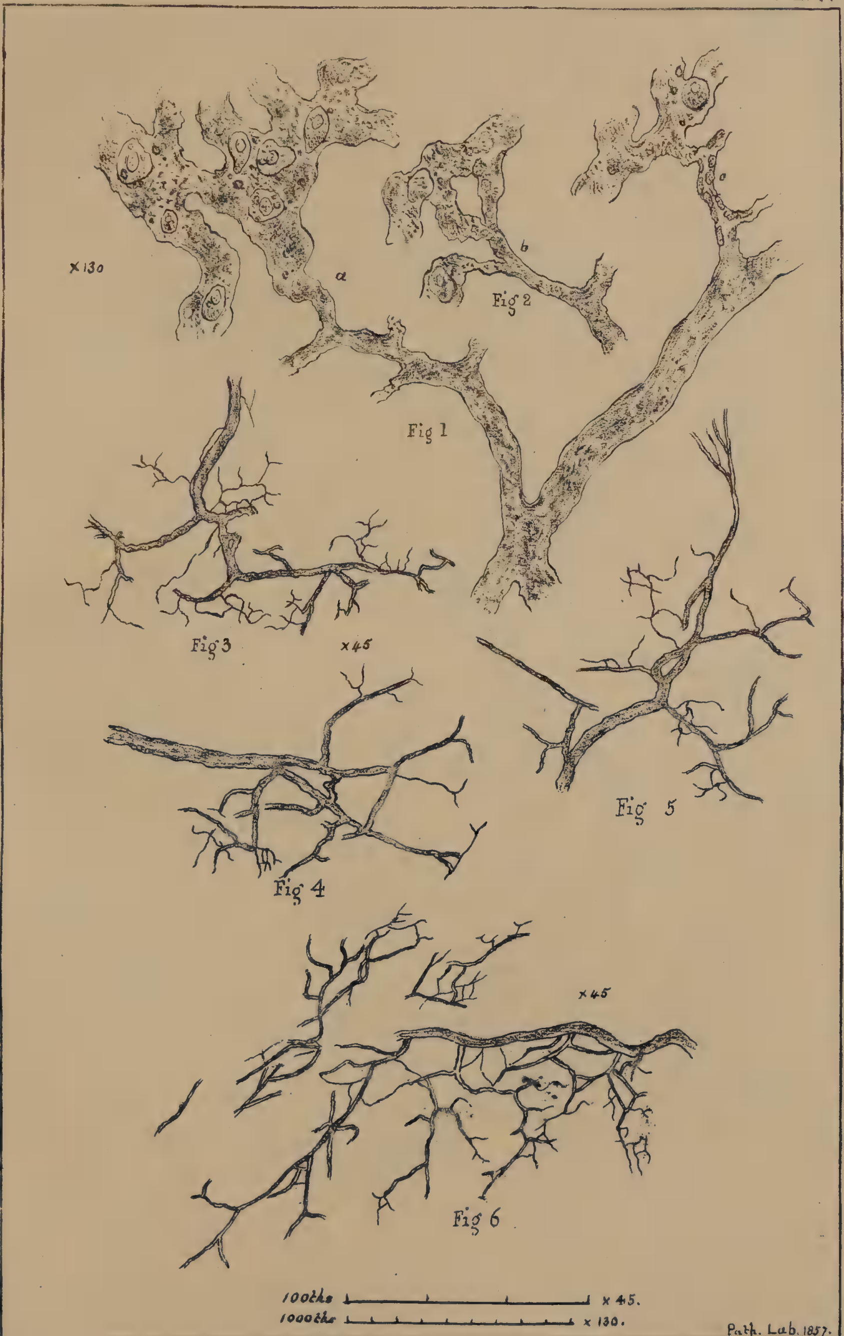


HEPATIC VEIN PIG'S LIVER. SECTION.



ARTERY. SURFACE OF PIG'S LIVER. 45 Ds.

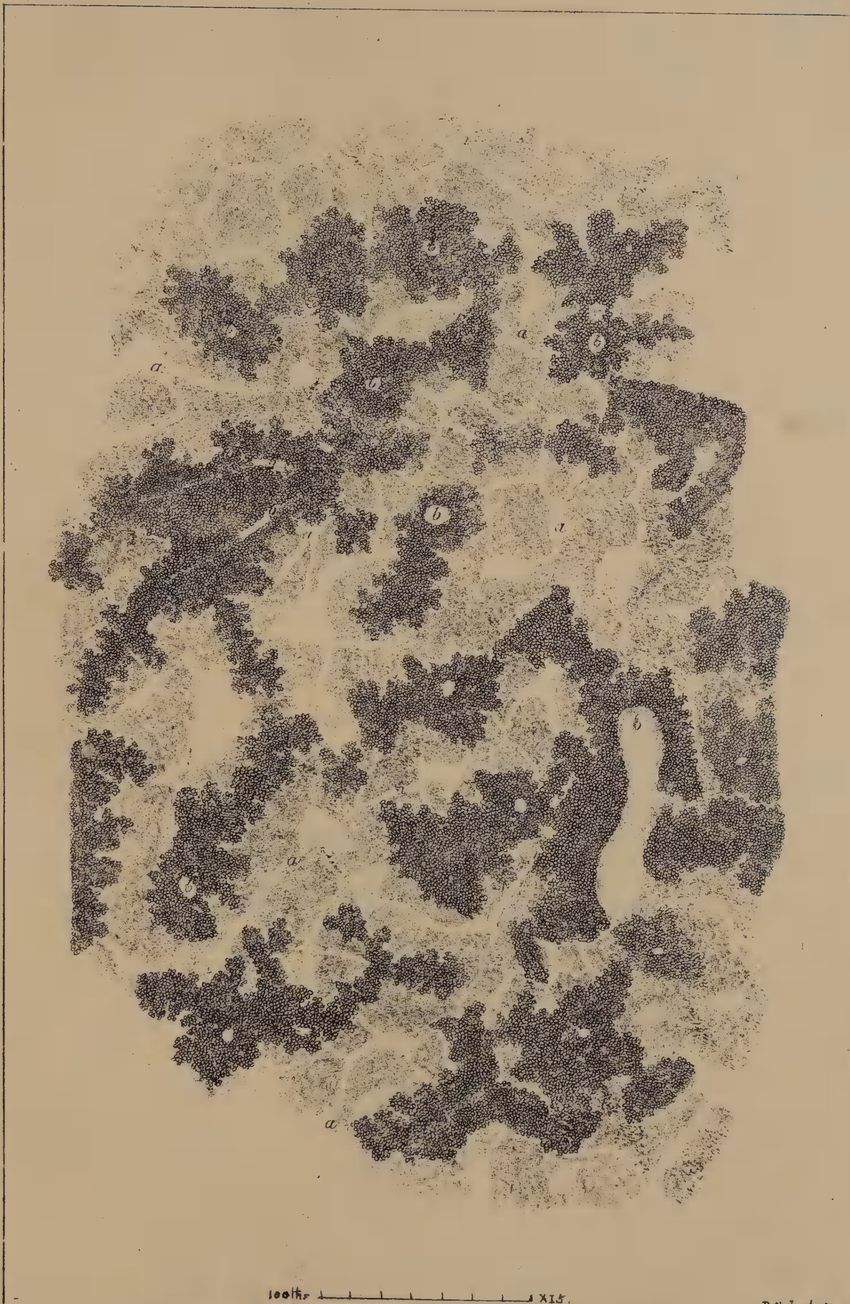
PLATE IV.



DUCT PIG'S LIVER.

PLATE V.

LIVER OF OX. PORTAL VEIN INJECTED ×15.



LIVER OF OX. HEPATIC VEIN INJECTED × 15.

PLATE VII.

Fig 1.

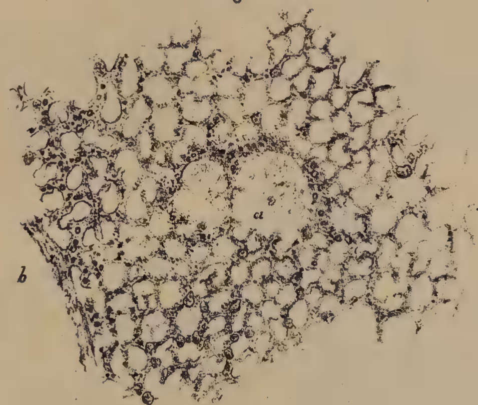


Fig 2.

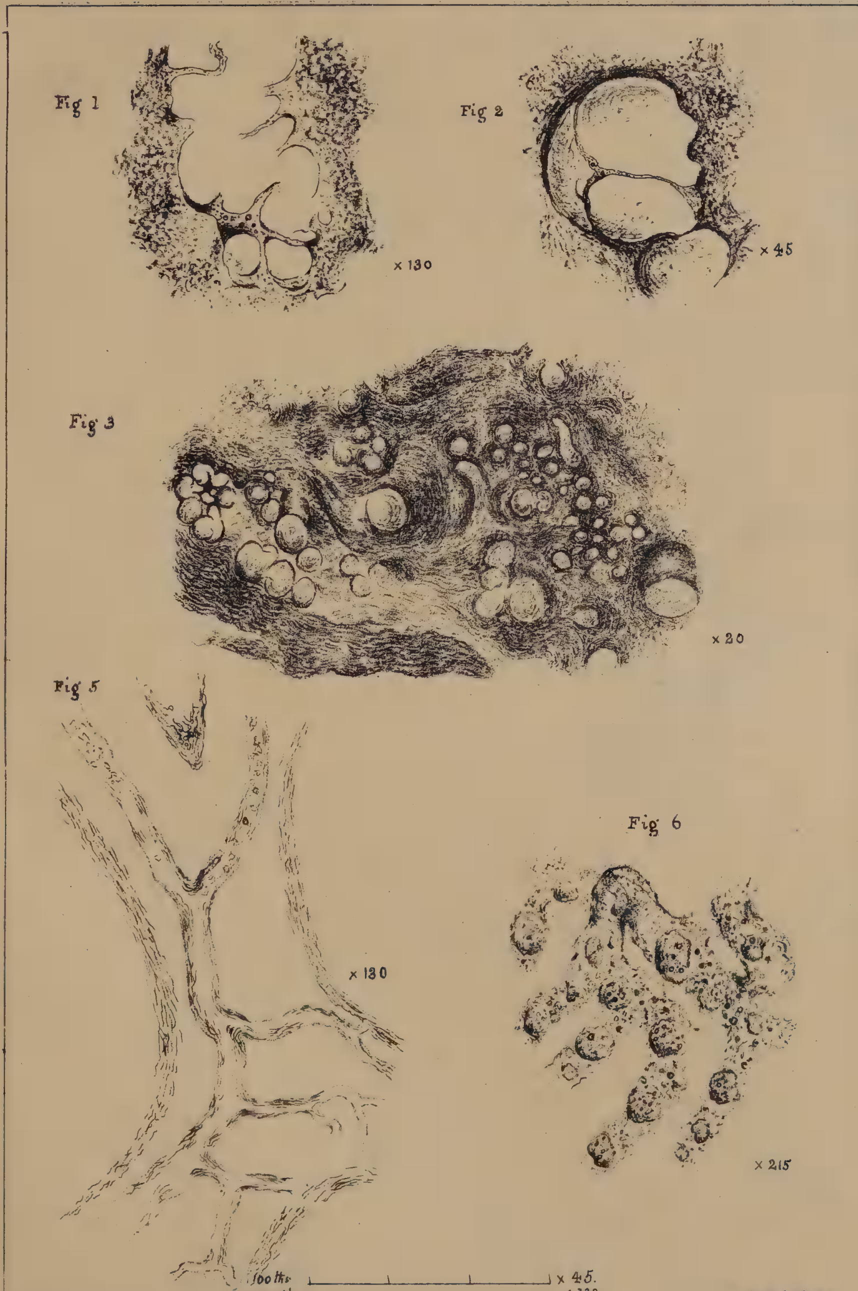
1000ths × 130.

Path. Lab. 1857.

LIVER CONTAINING CYSTS.

Fig 1 a. Small Cyst. Fig 2. Healthy portion.

PLATE VIII.



1.2.3. FROM LIVER WITH DILATED DUCTS. 4.5 FROM LIVER WITH CYSTS. PLATE VII.

1.2. Mass expectorated. 3. Tumor from Thyroid.
4.5. Tumor connected with Corpus Striatum.

PLATE X

GALL DUCTS SQUIRREL. Sciurus Vulgaris.

PLATE XI.

Fig. 1.

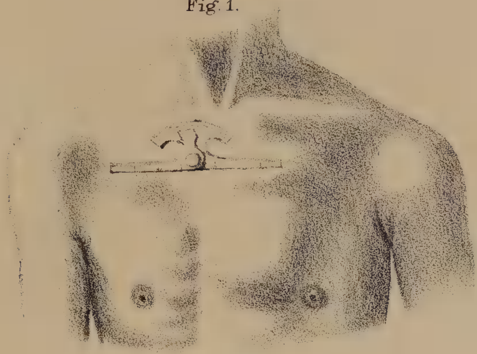


Fig. 2.

Fig. 3.

E. R. Johnson, fecit

PLATE XII.

Fig. 1.

Fig. 2.

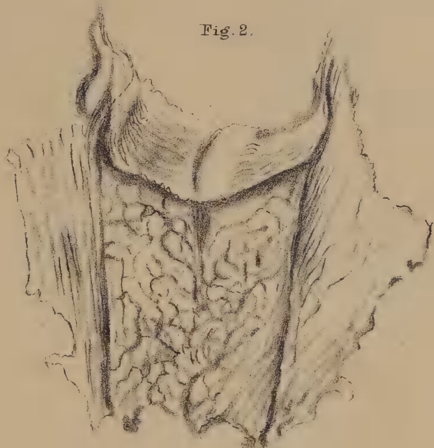


Fig. 3.

Fig. 4.

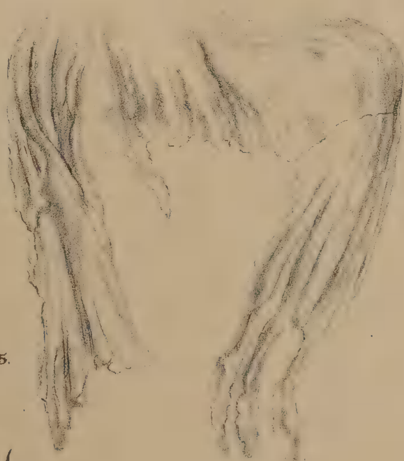


Fig. 5.

Dr. Farre, ad. nat. del. Path. Lab. 1858.

PLATE XIII.


Fig 1.
a
b
× 220
Fig 2
× 220
Fig 3
× 220
Fig 4
a
× 220
b
Fig 5.
× 220
Fig 6.
a
× 220
J.W. Hulke Esq. ad nat. del
1000 ths

PLATE XIV.

Harrison & Sons, St. Martin's Lane.

PLATE XV.

Fig. 1.

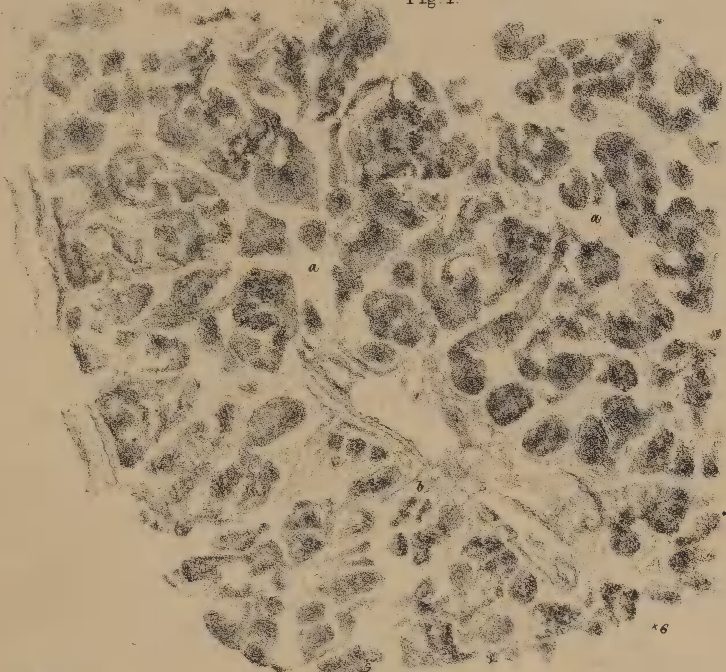
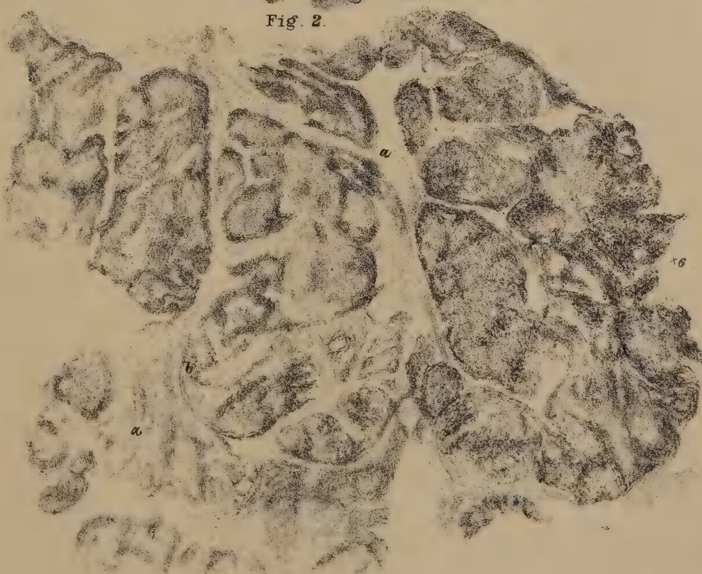


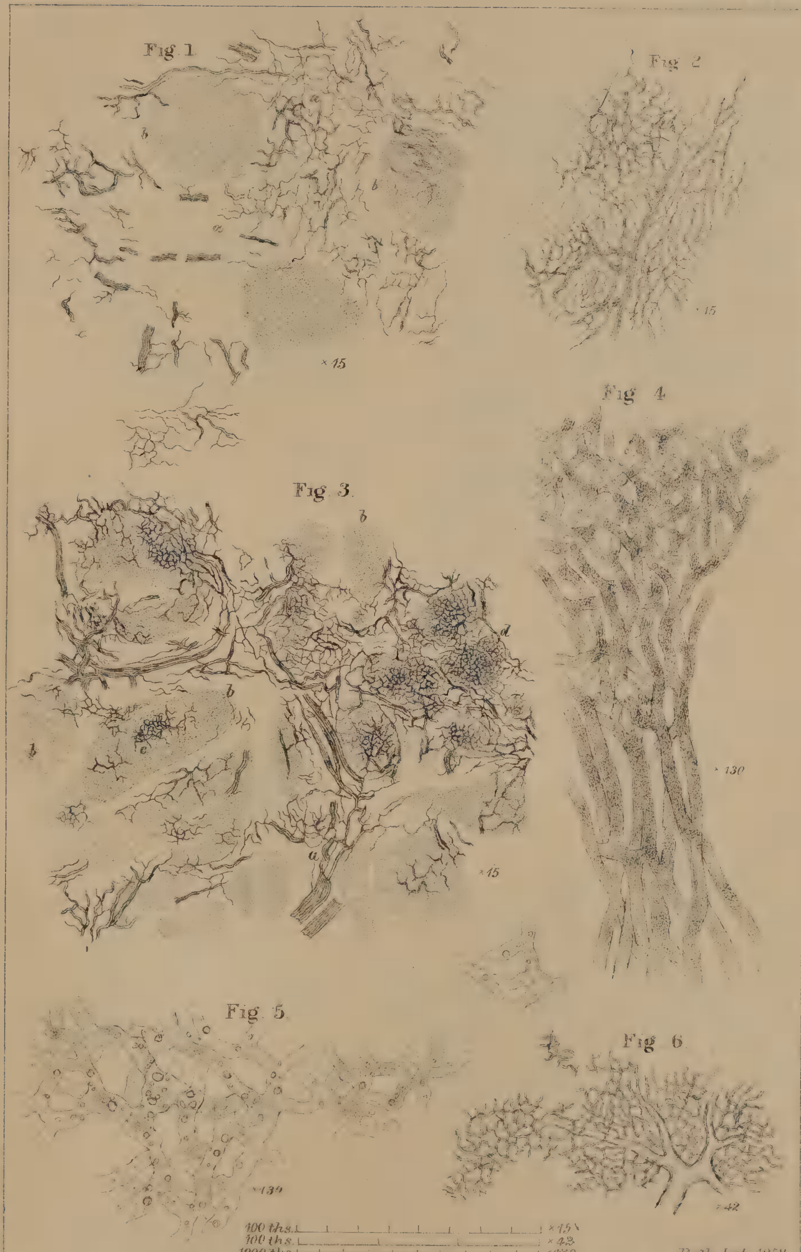
Fig. 2.



Path. Lab. 1858

PLATE XVI.

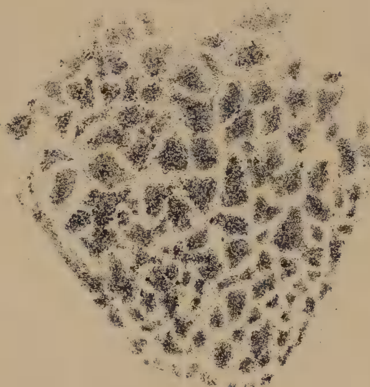

Fig 1
a
b
c
d
×215
Fig. 2.
×215
Fig. 4.
Fig 3
a
b
c
Fig 5
a
b
c
×215
Fig. 6.
×15
Fig 7
×15
100 ths
×15
1000 ths
×130
1000 ths
×215
Path. Lab. 1858



St Martins Lane.

PLATE XVIII.

Fig. 1.



Nat. Size

Fig. 2.

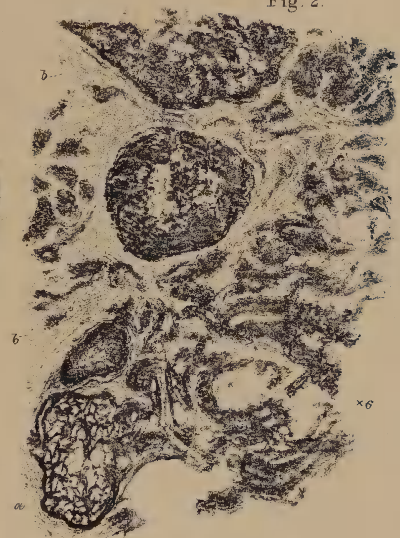
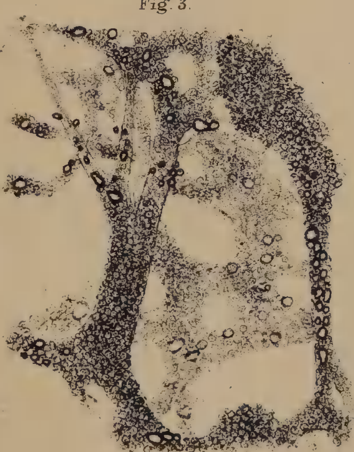


Fig. 3.



×215

Fig. 4.

100 ths. ×42
1000 ths. ×215

Path. Lab. 1858.

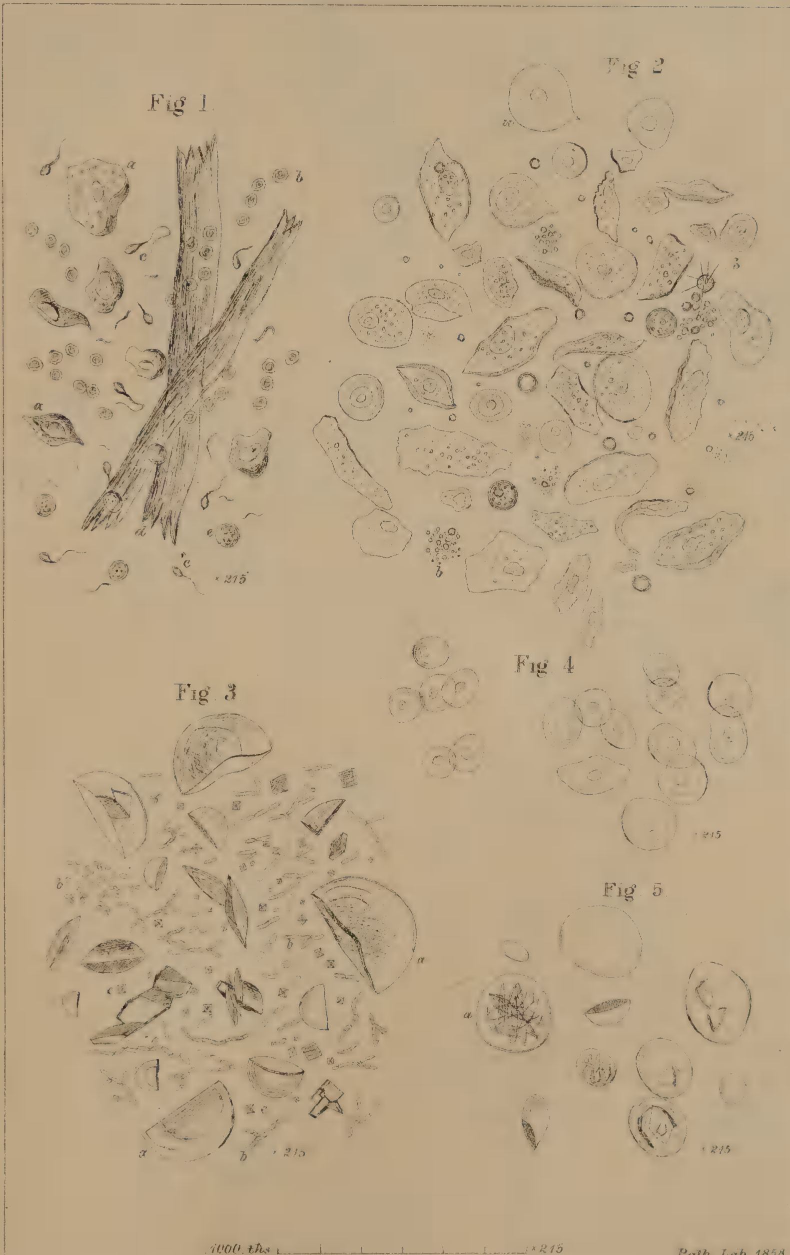
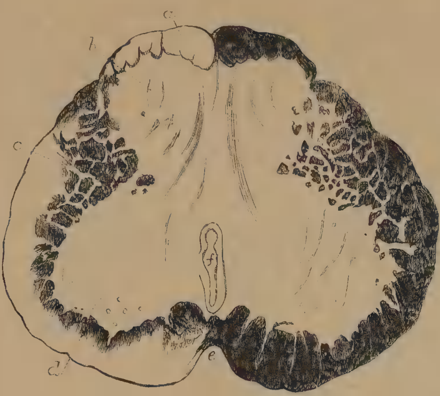


Fig 1
a
b
c
d
e
×215
Fig 2
a
b
×215
Fig 3
a
b
×215
Fig 4
×215
Fig 5
a
×215
1000 ths
×215
Path Lab 1858

Fig. 1.



× *about* 30.

Fig. 2.

× *about* 30.

Fig. 3.

× *about* 10.

Fig. 4.

× 10.

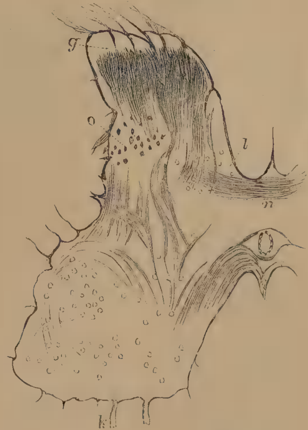
Fig. 5.

× 10.

Fig. 6.

× 10.

Fig. 7.



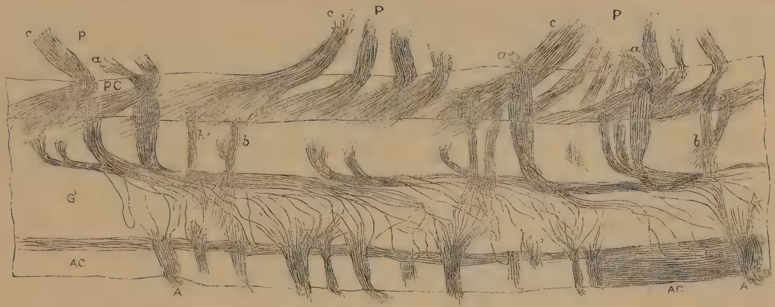
× 10.

LOCKHART CLARKE, delt.

WRAGG SS.,
Path. Lab., 1858.

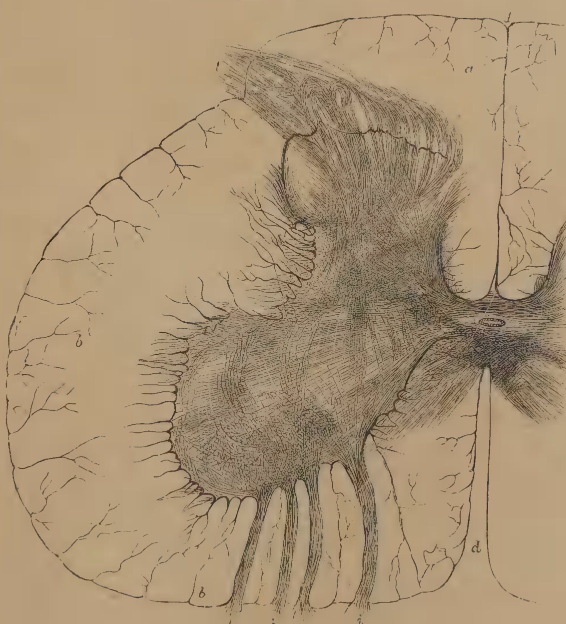
PLATE XXI.

Fig. 1.



× 15.

Fig. 2.

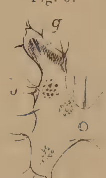


× 10.

Fig. 8.

× 10.

Fig. 9.



× 10.

LOCKHART CLARKE, delt.

WRAGG, SS.,
Path. Lab., 1858

Fig. 1.

Fig. 2.

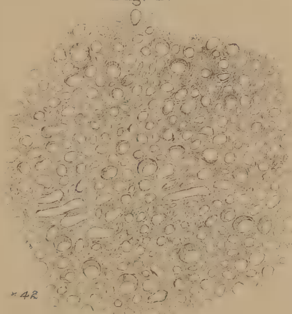


Fig. 3.

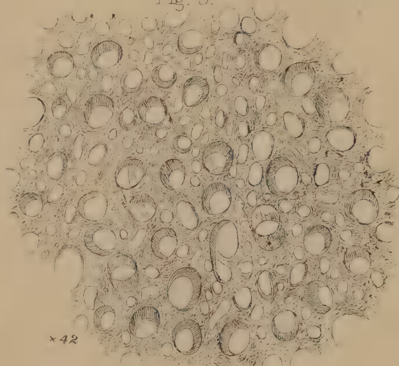


Fig. 4.

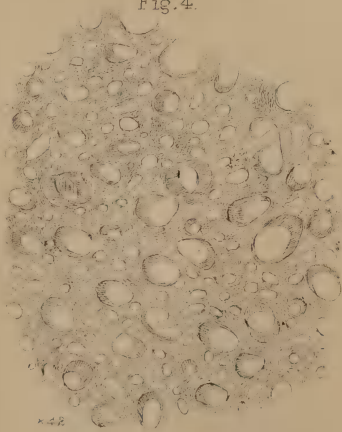
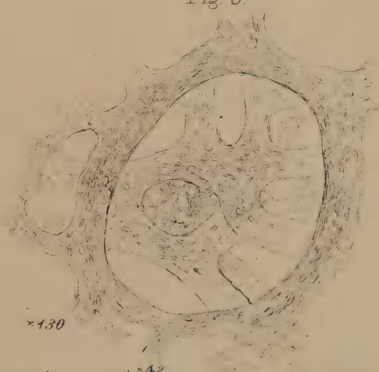


Fig. 5.



100 ths × 42

1000 ths. × 130

Path. Lab. 1858

Fig. 1.

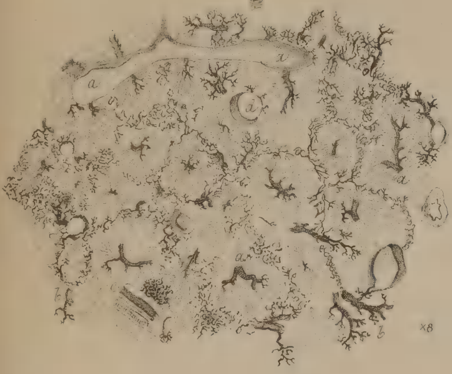


Fig. 4

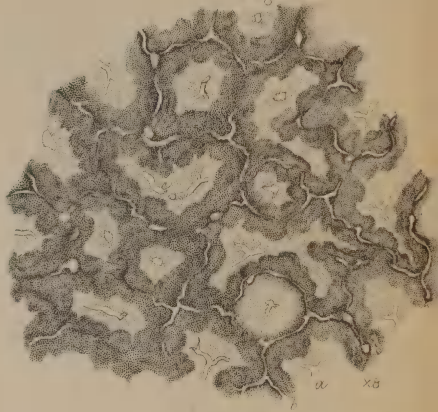


Fig. 2.

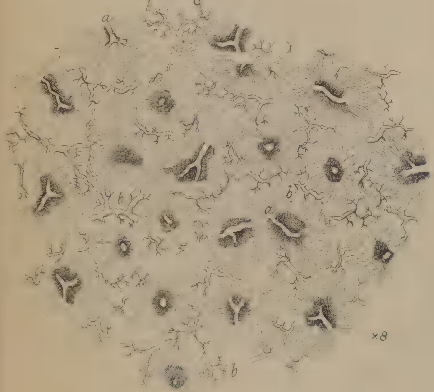


Fig. 5.

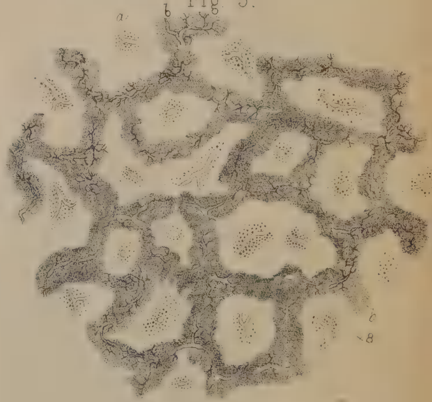


Fig. 3.

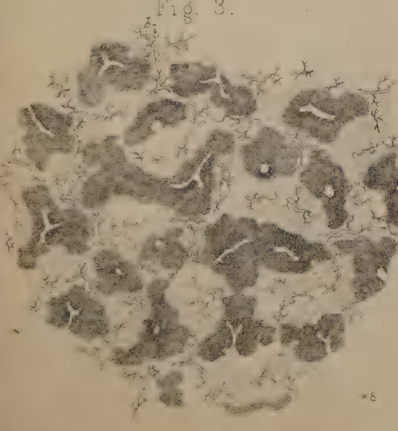
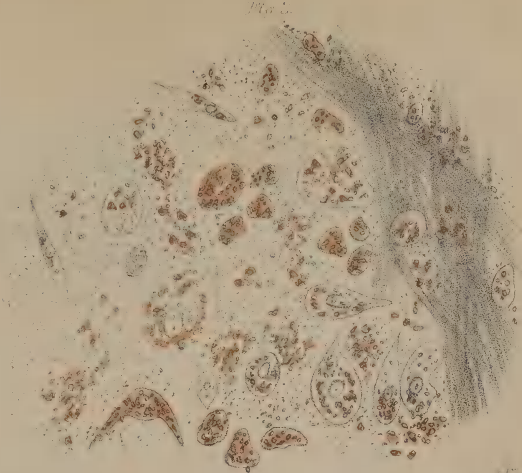


Fig. 6.

PLATE XXIV.



× 215

Fig. 1.

Fig. 3.

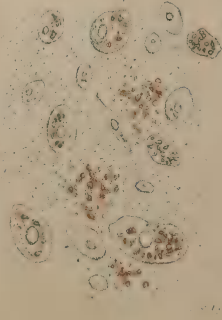
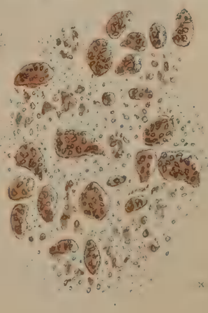


Fig. 2.



× 215

1000ths × 215

J.R. Crichton, lith.

Dr Murchison, del ad nat.

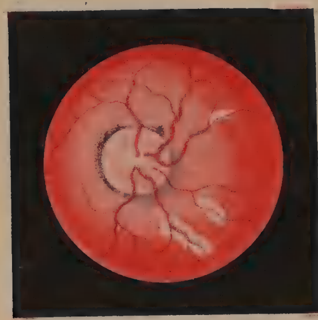
J. R. Crichton, lith

Path. Lab 1858.

PLATE XXVI.

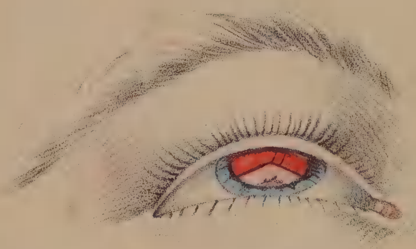
1

2



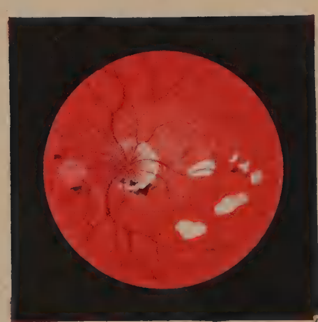
3

4



5

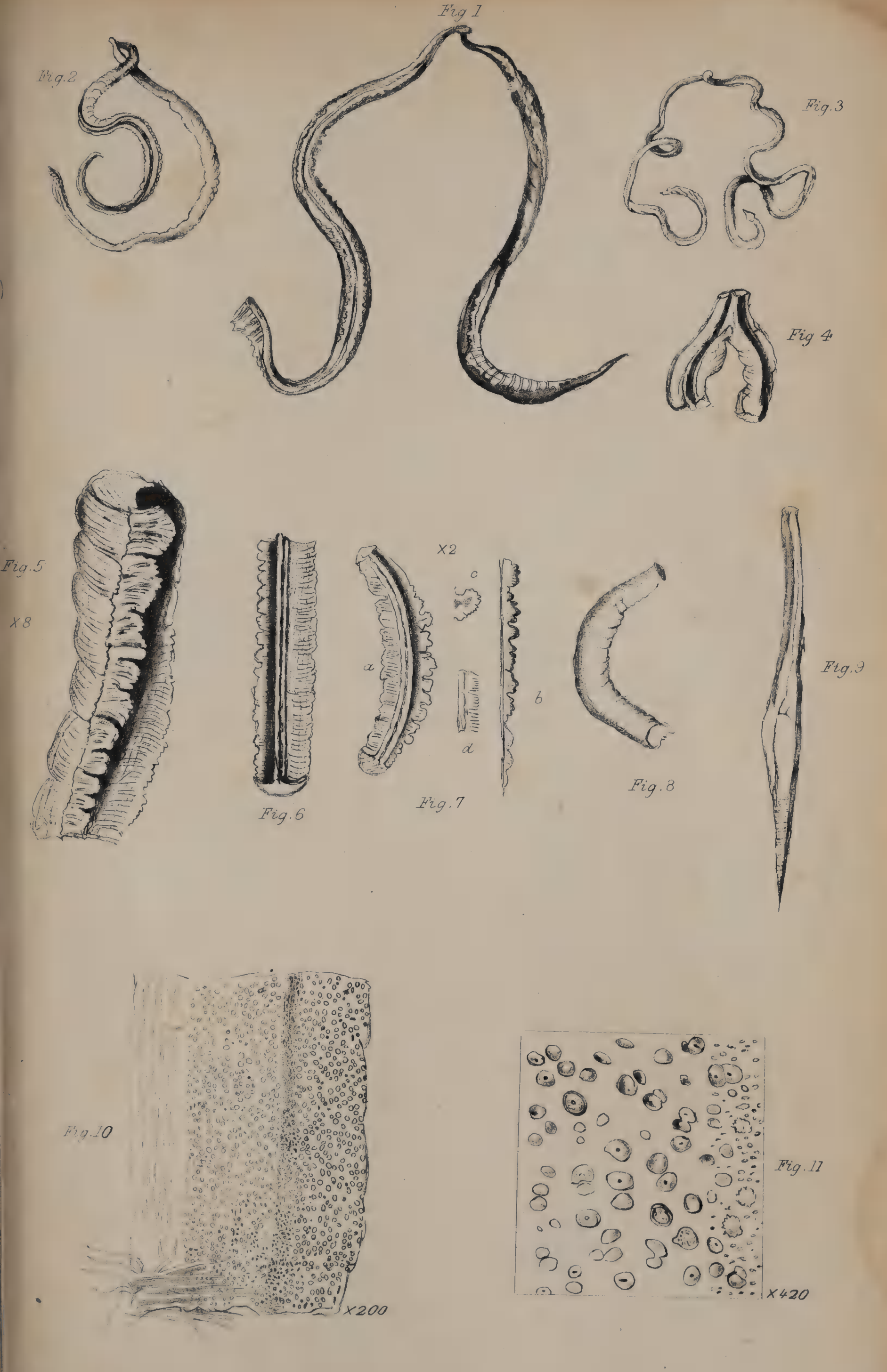
6



E.C.Hulme ad nat del. Tuffen West Chromo lith.

W West imp.

PLATE XXVII



Crichton lith

Arthur Farne M.D. del.

Fig. 12.

Fig. 13

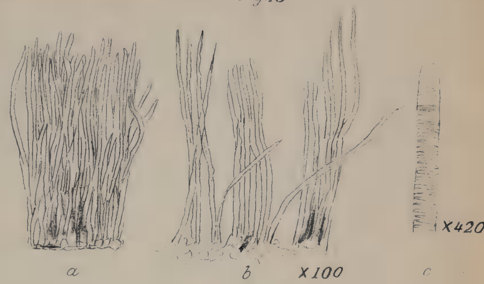


Fig. 14

Fig. 15.

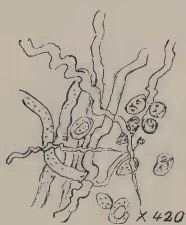


Fig 16

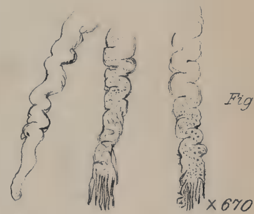


Fig 17

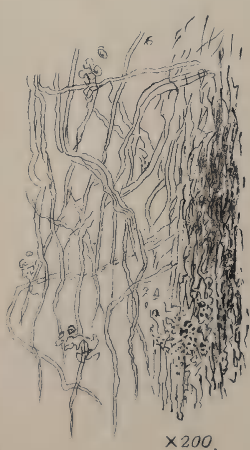
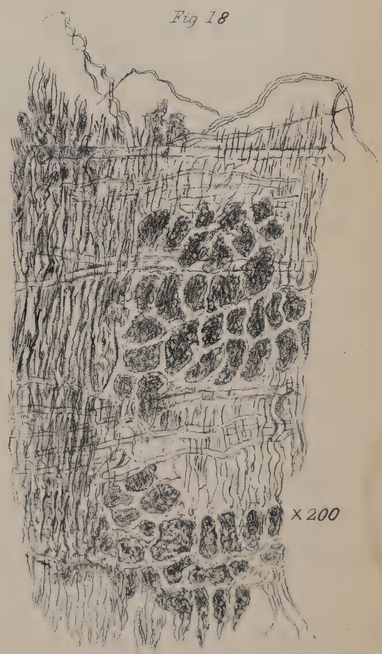


Fig 18



J. R. Crichton, Lith

Arthur Farne M.D. del.

all X 15.

LSB 1859

100ths X 15.

PLATE XXX

Fig 1

Fig 2.

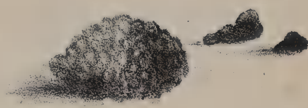
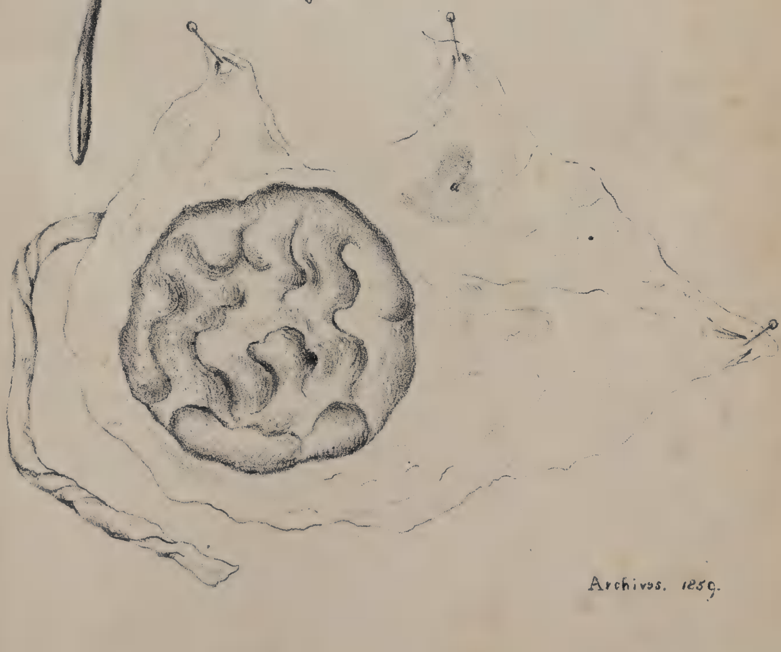


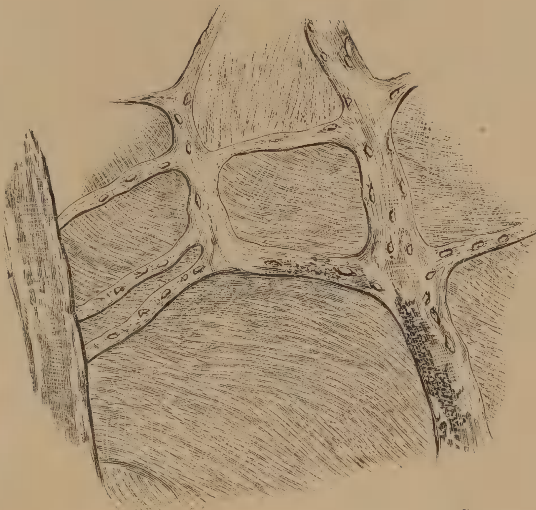
Fig 3

Fig 4



Archives. 1859.

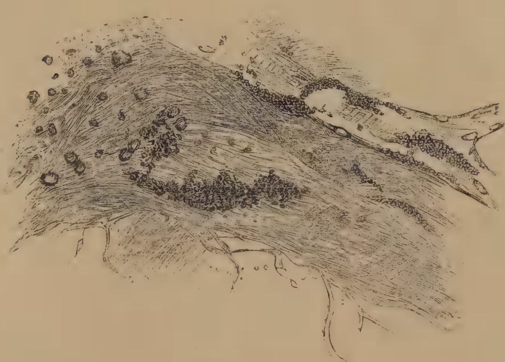
Fig. 1.



a

× about 260

Fig. 2.



a

× about 400

Fig. 1.

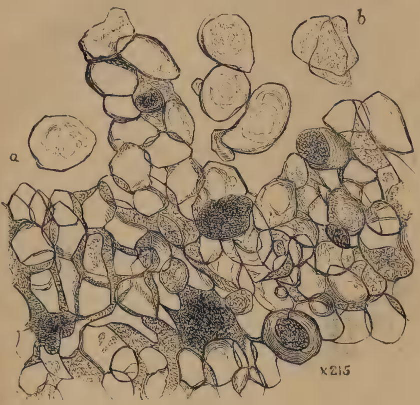


Fig. 2.

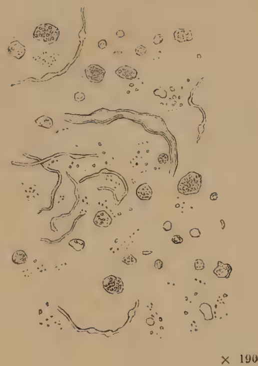
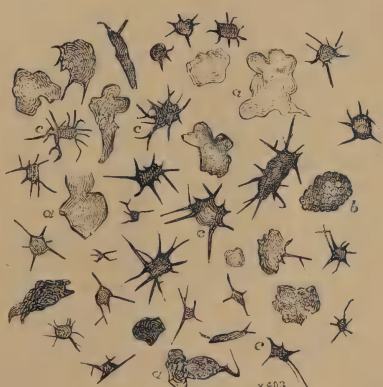


Fig. 4.

Fig. 3.



1000 ths × 403

1000 ths × 215

L. F. B. delt.

5 L